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Instructional Skills Evaluation in Nuclear Industry Training

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Analysis & Technology, Inc.

Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

This report provides information to nuclear power plant training managers and their staffs concerning the job performance requirements of instructional personnel to implement performance-based training programs (also referred to as the Systems Approach to Training.) The information presented in this report is a compilation of information and lessons learned in the nuclear power industry and in other industries using performance-based training programs.

The job performance requirements in this report are presented as instructional skills objectives. The process used to develop the instructional skills objectives is described. Each objective includes an Instructional Skills Statement describing the behavior that is expected and an Instructional Skills Standard describing the skills/knowledge that the individual should possess in order to have achieved mastery. The instructional skills objectives are organized according to the essential elements of the Systems Approach to Training and are cross-referenced to three categories of instructional personnel: developers of instruction, instructors, and instructional managers/supervisors.

Use of the instructional skills objectives is demonstrated for reviewing instructional staff training and qualification programs, developing criterion-tests, and reviewing the performance and work products of individual staff members.

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INSTRUCTIONAL SKILLS EVALUATION IN NUCLEAR INDUSTRY TRAINING

EXECUTIVE SUMMARY

This report provides information to nuclear power plant (NPP) training managers and their staffs concerning the job performance requirements of instructional personnel to implement performance-based training programs (Systems Approach to Training). The information provided in this report is a compilation of information and lessons learned in the nuclear power industry and in other industries using performance-based training programs.

The job performance requirements in this report are presented as instructional skills objectives. Chapter II describes the process used for development of the instructional skills objectives. Chapter III provides the instructional skills objectives. Each of the instructional skills objectives is provided in two parts:

Part 1. Instructional Skills Statement. A statement of the behavior that is expected of the performer.

Part 2. Instructional Skills Standard. The skills/knowledge that the individual should possess to show mastery of the behavior.

The instructional skills objectives are organized in Chapter III according to the essential elements of the Systems Approach to Training. Also provided in Chapter III is a cross-reference of these objectives to three categories of instructional personnel:

- Developers of instruction,

- Instructors, and

- Instructional managers/supervisors.

Chapter IV demonstrates the use of these instructional skills objectives for:

- Reviewing instructional staff training and qualification programs,
- Developing criterion-tests for evaluation of instructional staff qualifications, and
- Reviewing the performance and work products of individual instructional staff members.

CHAPTER I
INTRODUCTION

I.1 BACKGROUND

Nuclear power industry initiatives [such as Institute of Nuclear Power Operations (INPO) accreditation of utility training programs for nuclear power plant (NPP) personnel] are resulting in wide-spread conversion to performance-based training as the desired approach to the design, development, and implementation of training. The principal characteristics of a performance-based approach to training are summarized below:

1. What trainees learn. For performance-based training programs, what trainees learn is based solely on specific, precisely stated learning objectives that have been systematically derived and verified as being essential for adequate performance in the job for which the trainee is being trained.

2. How trainees learn. For performance-based training programs, trainees participate in carefully designed, trainee-centered learning experiences, using media and materials designed specifically to help them master each learning objective.

3. How trainees are evaluated. For performance-based training programs, each trainee has the opportunity to perform each learning objective in a job-like setting and to receive feedback on performance before being tested for mastery. Performance is compared to preset, fixed standards that are based on systematically determined job performance requirements.

The Nuclear Regulatory Commission (NRC), in response to the Nuclear Waste Policy Act of 1982, Section 306, issued a "Commission Policy Statement on Training and Qualification of Nuclear Power Plant Personnel" (Reference 1), in which the INPO training accreditation program was identified to be "an acceptable means of industry self-improvement in training." In this Policy Statement, the NRC allowed the industry a minimum of two years of accreditation activity without the introduction of new NRC training regulations.

This Commission Policy Statement stated that the following five elements are essential to acceptable training programs:

1. Systematic analysis of the jobs to be performed,
2. Learning objectives (derived from the analysis) that describe desired performance after training,
3. Training design and implementation based on the learning objectives,
4. Evaluation of trainee mastery of the objectives during training, and
5. Evaluation and revision of the training based on the performance of trained personnel in the job setting.

These five essential elements (while grouped differently) are the same as the elements of INPO's Training System Development (TSD) Approach (Reference 2) and the U.S. Military's Instructional System Development (ISD) model (Reference 3), as well as other performance-based or systems approaches to training.

Experience has shown that successful implementation of performance-based training programs is critically dependent upon the skills of instructional personnel in both:

1. The subject matter (the job for which personnel are being trained) and
2. The analysis, design, development, implementation, and evaluation of performance-based training (a discipline often referred to as instructional technology).

In general, designated instructional personnel within the nuclear power industry have been drawn from the pool of technically qualified job incumbents associated with each applicable discipline. Typically, they have not had the benefit of formal training or practical experience in instructional technology skills associated with performance-based training programs.

As utilities have implemented performance-based training programs, they have taken a variety of approaches toward the staffing, training, and qualification of the personnel assigned to this implementation. These approaches range from contracting out for the systematic analysis, design, and development of the training program (with little or no involvement by the instructional staff until program implementation) to expanding the instructional staff size and using a combination of subject matter experts (job incumbents) and instructors to complete the effort. A more common approach than either of the above is to expand the training organization to include an instructional development function and to staff this functional area with one or more instructional technologists (ITs) who are assigned lead responsibility for the analysis, design, development, and often the evaluation aspects of the performance-based training program.

No matter which approach is taken toward the staffing, training, and qualification of instructional personnel, the job-performance requirements to implement each of the elements of performance-based training programs are the same. The primary objective of this document is to provide guidance based upon existing information and lessons learned in other industries to nuclear power plant (NPP) training managers and their staffs in the form of objectives which should ensure an appropriate instructional skill level of NPP instructional personnel to support performance-based training programs.

I.2 APPROACH

The approach taken to develop a set of objectives articulating minimum instructional skill levels of facility training staffs to support a systems approach to training was one of assembling and distilling existing information rather than researching and developing new objectives. This approach can be summarized in the steps below:

1. Identify potential information sources for the objectives.

2. Assemble and prioritize the information.

3. Identify the subset of information that is applicable to the NRC's mission to protect the public health and safety.

4. Organize the objectives in a consistent and useful way.

5. Identify practical uses of the objectives in supporting implementation of a Systems Approach to Training (SAT).

I.3 ORGANIZATION

Chapter II of this report describes the approach used to develop the instructional skills objectives, and identifies the information sources used for this development. Chapter III provides these objectives, organized around the five essential elements of a Systems Approach to Training. Chapter IV provides examples of how these objectives might be used by facility training organizations. Finally, Appendix A provides a summary description of the information sources used to develop the instructional skills objectives.

CHAPTER II

DEVELOPMENT OF INSTRUCTIONAL SKILLS OBJECTIVES

II.1 INTRODUCTION

The approach taken to develop a set of instructional skills objectives comprised the following five steps:

1. Identify potential information sources for the objectives.
2. Assemble and prioritize the information.
3. Identify the subset of information that is applicable to the NRC's mission to protect the public health and safety, and to the nuclear power industry.
4. Organize the objectives in a consistent and useful way.
5. Identify practical uses of the objectives in supporting implementation of a Systems Approach to Training.

This chapter describes the conduct and results of each of the above steps.

II.2 IDENTIFYING POTENTIAL INFORMATION SOURCES

The information sources were selected based upon two or more of the following characteristics of the industry/organization:

- A mature SAT program,
- Directly related to the nuclear power industry, or
- Known contributions to the development of instructional skills training qualification programs.

Based upon these criteria, the following industries/organizations were selected:

- Military, particularly the U.S. military,
- Federal Aviation Administration (FAA),
- Institute of Nuclear Power Operations (INPO),
- U.S. Nuclear Regulatory Commission,
- U.S. Department of Energy,
- Nuclear service companies/training material vendors,
- Nuclear facility in-house programs, and
- Academic institutions/professional organizations.

II.3 ASSEMBLING AND PRIORITIZING INFORMATION

Information was collected through a combination of a literature search and interviews (primarily telephone interviews). Interviews generally were used to identify/request documentation that was not referenced in the open literature. In all cases, the information provided in this chapter is based upon written documentation.

Table 1 shows the prioritization that resulted from the review of the information collected. As shown in Table 1, the U.S. Air Force (USAF) was identified as a primary information source for the development, conduct, and management of performance-based training. This is the case because of recent/on-going efforts by the USAF Occupational Measurement Center that directly parallel the objectives of this project. In evaluating the USAF implementation of Instructional Systems Development (ISD) in 1970, Air Force studies have continually identified a principal weakness to be the training and qualification of instructional system managers, supervisors, and developers. In response to this need, in 1983 the USAF Occupational Measurement Center initiated a project to apply ISD to develop training and qualification programs for ISD managers,

TABLE 1
SUMMARY OF INFORMATION SOURCES

PROGRAM	SAT FUNCTIONS					
	DEVELOPMENT		CONDUCT OF INSTRUCTION		MANAGEMENT/SUPERVISION	
	Performance-Based Training	Performance-Based Evaluation	Performance-Based Training	Performance-Based Evaluation	Performance-Based Training	Performance-Based Evaluation
U. S. Air Force	X	X	X	X	X	X
U. S. Navy			o	o		
Canadian Forces		o	o	o		o
FAA	o	o	o	o		
INPO		o		o		o
NRC		x		x		
DOE		o		o		o
Nuclear Service/ Training Vendors	o		o	o	o	
Nuclear Facility In-House Programs	o	o	o	o	o	o
Academic/Professional		o		o		o

X = Principal Source(s)   o = Backup Source(s) supervisors, and developers. The USAF has made available to the NRC the task inventories, analyses, learning objectives, and criterion tests that have been developed through this project.

As shown in Table 1, the other primary source of information with respect to performance-based evaluations of the development and conduct of instruction was the NRC. In particular, a parallel NRC/NRR Division of Human Factors Safety project to develop training review criteria and procedures (Reference 4) was the principal NRC information source. These procedures are organized around the five essential elements of the Systems Approach to Training and are intended for use by NRC personnel in evaluating the progress of utilities in implementing performance-based training programs.

These primary information sources (as well as the backup sources) are described in Appendix A of this report.

II.4 IDENTIFYING THE SUBSET OF INFORMATION APPLICABLE TO THE NRC'S MISSION AND TO THE NUCLEAR POWER INDUSTRY

Of the primary sources of information, the NRC's document, "Training Review Criteria and Procedures" (Reference 4), was directly applicable to the NRC's mission to protect the public health and safety and was developed for use in the nuclear power industry. However, this was not the case for the USAF materials, the other primary information source. Two criteria were used in reviewing the USAF instructional materials to eliminate certain instructional skills objectives:

1. The objectives were not related to safety, and

2. The objectives were not unique to instructional jobs.

Based upon the application of these review criteria, objectives such as the following were eliminated:

- Prepare memos detailing constraints and trade-off decisions on personnel requirements.

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- Draft budget or financial requirements.
- Monitor purchases of equipment.
- Determine requirements for supplies.

It should be noted that the criterion that the objective be unique to the instructional job resulted in the elimination of the majority of the USAF objectives with respect to managers/supervisors. This criterion, however, is considered appropriate for the purposes of this report because the objective was not to identify objectives for evaluating the overall management or technical qualifications of instructional staff personnel, but to identify objectives for evaluating those instructional, management, and supervisory qualifications that are directly and uniquely related to the implementation of performance-based training programs in the nuclear power industry.

II.5 ORGANIZING THE OBJECTIVES IN A CONSISTENT AND USEFUL WAY

Unlike the NRC's document, "Training Review Criteria and Procedures," which was designed specifically to aid NRC personnel in conducting training program reviews, or the USAF materials which provided criterion-tests for a specific testing method, these instructional skills objectives were designed to provide a foundation for uses in several different ways including:

- Reviews of instructional staff training and qualification programs,
- Development of criterion-tests for individual instructional jobs, and
- Objective reviews of the performance and work products of instructional staff members.

For that reason, the instructional skills objectives were developed in the format shown in Figure 1. These objectives, organized around the five essential elements of a Systems Approach to Training, are provided in Chapter III of this report.

6.5 Demonstrate skill in obtaining and utilizing training program information obtained from supervisors.

STANDARD

Information should be solicited periodically from supervisors (annually is suggested) to determine how well the initial training program is preparing individuals to perform their jobs and what continuing training is needed for current job incumbents. The following types of information are relevant:

1. Tasks for which new job incumbents are inadequately prepared,
2. Kinds of errors being committed by job incumbents,
3. Additional training received by new job incumbents once they are on the job,
4. Suggestions for improvements in initial and continuing training programs, and
5. Expected changes in job assignments, procedures, or equipment.

Figure 1. Example Instructional Skills Objective

II.6 IDENTIFYING PRACTICAL USES OF THE OBJECTIVES

In Section II.5, three uses of the objectives to support implementation of a Systems Approach to Training were described. Chapter IV of this report provides examples of the objectives used for each of these applications.

CHAPTER III
INSTRUCTIONAL SKILLS OBJECTIVES

III.1 INTRODUCTION

This chapter provides the instructional skills objectives, organized around the five essential elements of a Systems Approach to Training, as follows:

1. Overview of a Systems Approach to Training,
2. Systematic analysis of the job,
3. Learning objective development,
4. Training design and implementation,
5. Trainee evaluation, and
6. Program evaluation.

It is recognized that not all of these instructional skills standards are applicable to any one job/position within a utility training organization. Table 2 shows a cross-reference of these instructional skills objectives between the elements of a Systems Approach to Training (as shown above) and personnel in three categories of instruction:

- Development of instruction,
- Conduct of instruction, and
- Instructional management/supervision.

TABLE 2

CROSS-REFERENCE OF INSTRUCTIONAL SKILLS OBJECTIVES

ESSENTIAL ELEMENTS OF A SYSTEMS APPROACH TO TRAINING	CATEGORIES OF INSTRUCTIONAL PERSONNEL		
	DEVELOPMENT OF INSTRUCTION	CONDUCT OF INSTRUCTION	INSTRUCTIONAL MANAGEMENT/ SUPERVISION
1. Overview of a Systems Approach to Training	1.1*, 1.2, 1.3, 1.4, 1.5, 1.6	1.1, 1.2, 1.3, 1.4, 1.5, 1.6	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9 1.10, 1.11, 1.12
2. Systematic Analysis of the Job	2.1, 2.2, 2.3, 2.4, 2.5, 2.8		2.6, 2.7, 2.8
3. Learning Objective Development	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7	3.7
4. Training Design and Implementation	4.2, 4.3, 4.4, 4.5, 4.17	4.2, 4.3, 4.6. 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17	4.1, 4.18, 4.19, 4.20, 4.21, 4.22, 4.23
5. Trainee Evaluation	5.1	5.1, 5.3, 5.4, 5.5	5.2, 5.5
6. Program Evaluation	6.1, 6.2, 6.4, 6.5, 6.6	6.2, 6.3, 6.7, 6.8, 6.9, 6.10	6.2, 6.11, 6.12, 6.13

*These are the numbers of the instructional skills objectives in Section III.2

III.2 INSTRUCTIONAL SKILLS OBJECTIVES

Each of the instructional skills objectives is provided on a separate page in two parts.

Part 1. Instructional Skills Statement. A statement of the behavior that is expected. An example is shown below:

1.2 Identify the principal characteristics of the Systems Approach to Training.

Part 2. Instructional Skills Standard. The skills/knowledge that the individual should possess to have mastered the behavior. An example is shown below:

STANDARD

The principal characteristics of the Systems Approach to Training are:

1. What trainees learn. For performance-based training programs, what trainees learn is based solely on specific, precisely stated learning objectives that have been systematically derived and verified as being essential for adequate performance in the job for which the trainee is being trained.

2. How trainees learn. For performance-based training programs, trainees participate in carefully designed, trainee-centered learning experiences using media and materials designed specifically to help them master each learning objective.

3. How trainees are evaluated. For performance-based training programs, each trainee has the opportunity to perform each learning objective in a job-like setting and to receive feedback on performance before being tested for mastery. Performance is compared to preset, fixed standards that are based on systematically determined job performance requirements.

1. OVERVIEW OF A SYSTEMS APPROACH TO TRAINING (SAT)

1.1 Demonstrate knowledge of the essential elements of a Systems Approach to Training, their relationship, and their significance to performance-based training.

STANDARD

The five essential elements of a Systems Approach to Training address the principal activities associated with an SAT:

- Analysis. The analysis is based on established methods for job and task analysis. This procedure ensures that the training program encompasses all functions required for job performance.
- Learning Objective Development. Performance data and knowledge and skill requirements (identified during job analysis) are used to develop learning objectives. Because they are derived from actual job performance, basing subsequent training program development on these learning objectives ensures that the training will be relevant to the job performance requirements.
- Training Program Design and Implementation. The learning objectives are organized in the order in which they must be mastered. A training program is designed in which the learning objectives are arranged in this same order, the instructional methods and media are selected or developed, and the plan for conducting the training is developed. The training program is then implemented.
- Trainee Evaluation. The program is continuously evaluated based on trainee performance during and after training. Tests based on the learning objectives are developed to measure trainee mastery of the objectives and to provide feedback.
- Program Evaluation. The performance of training program graduates on the job is continually evaluated to identify training program weaknesses. The training program is systematically modified to accommodate changes required by identified deficiencies and changes external to the program. This process ensures the continued effectiveness of the program and the currency of program subject matter content.

1.2 Identify the principal characteristics of the Systems Approach to Training.

STANDARD

The principal characteristics of the Systems Approach to Training are:

1. What trainees learn. For performance-based training programs, what trainees learn is based solely on specific, precisely stated learning objectives that have been systematically derived and verified as being essential for adequate performance in the job for which the trainee is being trained.

2. How trainees learn. For performance-based training programs, trainees participate in carefully designed, trainee-centered learning experiences using media and materials designed specifically to help them master each learning objective.

3. How trainees are evaluated. For performance-based training programs, each trainee has the opportunity to perform each learning objective in a job-like setting and to receive feedback on performance before being tested for mastery. Performance is compared to preset, fixed standards that are based on systematically determined job performance requirements.

1.3 Demonstrate knowledge of the key characteristics of the behavioral approach to learning and its implications for effective instruction.

STANDARD

Key characteristics of the behavioral approach to learning are:

- People learn by having their behavior reinforced.
- A person's behavior can be shaped or controlled by someone else.

The implications of this approach for effective instruction are:

- Instructors can manipulate the classroom environment (stimuli) to give trainees a chance to behave or perform (respond) in the desired way that can be rewarded (reinforced).
- In the classroom, the "someone else" is the instructor.

1.4 Demonstrate knowledge of the key characteristics of the cognitive approach to learning and its implication for effective instruction.

STANDARD

The key characteristics of the cognitive approach to learning are:

- o Learning is a change in the way a trainee thinks or understands, not just a change in behavior.
- o Motivation, generalizing, insight, and discovery are significant concepts.

The implications of this approach for effective instruction are:

- o Instructors are responsible for setting up an environment that motivates trainees.
- o Through learning experiences, trainees should understand what they study.
- o Positive reinforcement is important.
- o Written and performance tests are necessary to measure behavior as an indication of what the trainee understands.

1.5 Demonstrate knowledge of the concept of levels of learning and its hierarchical organization.

STANDARD

A widely accepted taxonomy (or hierarchical organization of the levels of learning) was developed by B. S. Bloom and is presented below:

Level of Learning	Mental Activity
Evaluation	Exercise learned judgement
Synthesis	Create new relationships
Analysis	Determine relationships
Application	Use generalizations in specific instances
Comprehension	Translate, interpret, and extrapolate
Knowledge	Recall and recognition

1.6 **Demonstrate knowledge of the concept of learning outcomes and its relationship to levels of learning.**

STANDARD

Instructors are unable to directly observe trainees knowing, comprehending, or applying. But both instructors and trainees need to know how well the level of learning has been achieved. The vehicle used to determine achievement of a specific level-of-learning is called a sample of behavior. A sample of behavior is defined as a statement that specifies one of several observable behaviors that trainees should be able to demonstrate at the end of a block of instruction and that gives evidence that they have achieved the specific level of learning. These samples are also known as learning outcomes and become the basis for evaluation, most often in the form of test questions. The learning outcomes associated with each level of learning are defined below.

Level of Learning/Learning Outcome	Sample Behavioral Verbs
Knowledge. The recall or recognition of previously learned material (facts, theories, etc.) in essentially the same form as taught.	list, name, match, describe, define, state, . . .
Comprehension. Seeing relationships, concepts, and abstractions beyond the simple remembering of material. Typically involves translating, interpreting, and estimating future trends.	explain, compare, contrast, predict, summarize, identify, distinguish, . . .
Application. The ability to use learned material in new and concrete situations, including the application of rules, methods, concepts, principles, laws, and theories.	solve, compute, prepare, use, develop, conduct, teach, . . .
Analysis. The ability to divide material into its component parts so that the organizational structure may be understood, including the identification of the parts, analysis of the relationships between parts, and recognition of the organizational principles involved.	classify, . . .
Synthesis. The ability to put parts together to form new patterns or structures, such as a unique communication (a theme or speech), a plan of operations (a research proposal), or a set of abstract relations (schemes for classifying information).	relate, create, . . .
Evaluation. The ability to judge the value of material for a given purpose. Learning in this area is the highest in the cognitive hierarchy because it involves elements of all the other categories, plus conscious value judgements based on clearly defined criteria.	judge, . . .

1.7 Demonstrate knowledge of senior management roles in the SAT process.

STANDARD

Senior management is generally responsible for:

- Assuring that procedures and tools for training program operation are in place and are adhered to. (Note that operation includes development and implementation.)
- Assuring that required resources are made available for training program operation.
- Establishing the goals and direction for training program operation.
- Initial decisions regarding program/course implementation, changes, or revisions, to include course or revision scope.

1.8 Demonstrate knowledge of mid-level management roles in the SAT process.

STANDARD

Mid-level management is generally responsible for:

- Establishing procedures and tools for training program operation.
- Allocating available resources as required to ensure effective training program operation.
- Establishing schedules governing training program operation.
- Ensuring training program quality.
- Establishing requirements for all personnel involved in training program operation and establishing a system to assure that those requirements are met and maintained.
- Preparing recommendations regarding program/course implementation, changes, or revisions including course or revision scope, and implementing those recommendations as approved.

1.9 Demonstrate knowledge of supervisory management roles in the SAT process.

STANDARD

Supervisory personnel are generally responsible for:

- o Review and approval of job and task analysis output, learning objectives, course design and method/media selection.
- o Execution of internal and external training program evaluations.
- o Conduct of instruction.
- o Recommending plans and schedules for the design, development, and implementation of a training program, to include changes and revisions; and implementing these recommendations as approved.
- o Resources expended in training program operation.
- o Monitoring training program operation.

1.10 Demonstrate knowledge of the principal resource considerations that must be addressed in the effective management of SAT-based instructional development and implementation.

STANDARD

Principal resource considerations include discussion of the following elements:

- Identification of constraints (time, personnel, resources, etc.) that need to be considered in planning for SAT-based instructional development and implementation.
- Identification of trade-off decisions associated with resource allocation that need to be considered in planning for instructional development and implementation.
- Identification of personnel requirements, constraints and trade-off decisions that need to be considered in planning for SAT-based instructional development and implementation.
- Identification of alternative plans for instructional development and costs to support the decision process.

1.11 Demonstrate knowledge of the various quality control checks incorporated in the SAT process.

STANDARD

Quality control checks include discussion of the following:

- Use of instructional programs and course control documentation.
- The degree of correlation between task analysis data, learning objectives, and (student or course) evaluation instruments.
- The degree of appropriateness of instructional design, methods, and media to the training content and underlying task performance.
- The degree to which instructional program design and implementation (e.g., lesson plans, supporting materials, instructional methods) adhere to established principles of instruction.
- Instructional validation and internal and external evaluation procedures.
- Schedule adherence and effective, efficient use of facilities and equipment.

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1.12 Demonstrate knowledge of common problems encountered in the SAT process.

STANDARD

Common problems encountered in the SAT process include:

- Failure to meet program milestones and to adhere to established schedules.
- Insufficient resources to develop/operate the program.
- Resources not available when required (facilities, equipment, instructor personnel, etc.).
- Participating personnel not adequately qualified.
- Quality standards not maintained.
- Lack of communication among program participants and management.

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2. SYSTEMATIC ANALYSIS OF JOBS TO BE PERFORMED

2.1 Demonstrate skill in using a systematic method for identifying the tasks that make up a job(s) for which training is to be developed.

STANDARD

A method or procedure is considered to be systematic if it possesses the following characteristics:

- Consists of a logically ordered set of steps,
- Is clearly documented so that it can be executed with consistent results on different occasions by different personnel,
- Requires a physical record (e.g., signature) of external review/approval for historical accountability, and
- Results in a consistently formatted, quality product (where applicable).

Identification of tasks that make up a job (i.e., plant-specific task list) should include the following:

- Involvement in the process by experienced training professionals and job incumbents, and
- Validation of the initial task list by two or more job incumbents through interview, survey, or a group review meeting, and
- Approval of the task list by managers/supervisors of subject matter and training personnel.

A task is a unit of work that describes the performance of a complete meaningful function in a job. An example of a task for the health physics (radiation protection) technician job is:

"Perform pre-Radiation Work Permit (RWP) surveys."

2.2 Demonstrate skill in the use of a systematic method for selecting tasks for which training is to be developed.

STANDARD

To systematically select tasks for formal training, there must be a basis for selections. The following criteria are generally used as the basis for selecting tasks for training:

- Percent of job incumbents who perform the task,
- Percent of time spent performing the task,
- Consequences of inadequate performance,
- Frequency of task performance,
- Task learning difficulty (or task performance difficulty),
- Time between job entry and task performance (or task delay tolerance), and
- Entry-level skills and knowledge (e.g., job tasks performed in previous jobs).

The selection process should also distinguish clearly those tasks requiring only initial training and those requiring continuing training as well. In general, the following three criteria are used in selecting tasks for continuing training (in addition to the criteria used to select tasks for initial training):

1. Consequences of Inadequate Performance. Those tasks whose performance is so critical that particular attention must be paid to ensuring adequate performance.

2. Frequency of Performance. The subset of tasks selected for initial training for which proficiency is not maintained through on-the-job performance (e.g., tasks that are performed infrequently).

3. Decay in Task Performance over Time. Those tasks that require periodic practice to maintain proficiency (particularly tasks requiring coordinated psychomotor skills).

Information concerning these criteria should be collected in an objective, reliable way and should be obtained from individuals who are familiar with the particular job being analyzed. Threshold values for task selection decisions should be established by qualified training specialists.

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2.3 Demonstrate knowledge of a systematic method for determining the task characteristics, skills, and knowledge requisite to satisfactory task performance.

STANDARD

Task characteristics include cues, conditions, and standards of performance.

A cue is the event that determines, in the job situation, when the job incumbent performs a particular task (i.e., "when the tank high level alarm is activated"). Conditions are the on-the-job conditions that significantly influence performance of a task (i.e., "given that the reactor coolant system is at normal operating temperature and pressure"). Standards describe the criteria or standards of performance of a task that separate "acceptable" from "unacceptable" job performance (i.e., "tank level must be maintained between high and low level trip set points").

Cues, conditions, and standards are necessary because they strongly influence decisions about training.

Task analysis is the process of identifying the skills and knowledge that are necessary for a job incumbent to adequately perform assigned tasks. The task is first divided into elements or steps. The skills and knowledge required for each element/step are then determined.

An example of a task statement is the following:

"Given the disassembled parts of a service water pump, proper tools, and the approved procedure, reassemble the pump in accordance with the steps of the approved procedure."

2.4 Demonstrate knowledge of how to use the entry level characteristics of the trainee population.

STANDARD

A systematic task analysis may include assumptions about the skills and knowledge associated with a particular level of education (e.g., a high school graduate) and then require the analysis to identify additional skills and knowledge required for adequate job performance.

Once skills and knowledge are identified, two alternatives are available to ensure that job incumbents possess them.

a) Select individuals who already possess these skills and knowledge or

b) Train the individuals selected for the job in these skills and knowledge.

If alternative a) is used, then these skills and knowledge should become part of the selection criteria for candidates. If a decision is made not to include a particular skill in the training program, then the skill should be included in the basis for selecting candidates for the training (i.e., either in a selection test or objective review of previous experience).

If alternative b) is used, these skills and knowledge should be included in the training program.

2.5 Demonstrate skill in the use of a systematic method for evaluating external information (e.g., on-the-job performance problems, industry events) as input to the training development process.

STANDARD

An analysis of on-the-job performance problems should be based on a systematic method of collecting the necessary information, from sources such as:

- LER's,
- Industrial accident reports, and
- Plant events, resulting from personnel errors, not requiring LER's (i.e., equipment damage, unscheduled maintenance, outage extensions).

Much of this information may be available in written reports; however, often there is a reluctance to document personnel errors because of concern about the effect on the individual. For this reason, there is often a need to supplement the information in written reports with interviews of supervisors and engineers.

In analyzing the information for training implications, two common problems arise:

- The general assumption is made that additional training is the solution to all personnel errors. The analysis should consider other potential solutions also, e.g., procedure changes, work design/workloads, equipment design changes, and level of supervision.
- The root causes of human performance problems are not identified. For example, a pattern of corrective actions that state, "remedial training was provided to the individual(s) involved," may be indicative that only a cursory analysis of the cause of the problem has been performed.

Industry events that may be applicable to the facility and subsequent incorporation of applicable experience into training programs should be screened and evaluated. INPO has implemented the Significant Event Evaluation and Information Network (SEE-IN) for operating experience review. A satisfactory means for meeting this requirement would be a systematic method for facility-specific review of INPO Operations and Maintenance Reminders, SER's and Significant Operating Experience Reports, and incorporation of applicable recommendations.

2.6 Demonstrate knowledge of a plan for implementing and monitoring front-end analysis activities of a training development project.

STANDARD

A satisfactory plan will include:

- Procedures for implementing, conducting, and monitoring the needs analysis, collecting job and task analysis data, establishing entry level characteristics of the target population, and selecting tasks/content for instruction.
- Identification of the types of management decisions that will be required concerning time, personnel, resources, budget, and trade-offs between program requirements and constraints.

2.7 Demonstrate knowledge of the elements of a plan for obtaining task analysis, target population analysis, and job performance data.

STANDARD

A satisfactory plan will specify:

- Personnel requirements including the number and qualifications of personnel required, from what sources (internal, staff, external) they can be obtained, and what organizational support they will require.
- Sources for the appropriate data such as the results of previous generic industry and plant-specific analysis, operating procedures, other engineering documentation (technical manuals, etc.), and previous or similar course documentation.
- Estimated milestones for specific stages of the effort (development, implementation, maintenance) including considerations of staff availability, work assignments, assignment workload, and schedule.
- Procedures and guidelines to be used in completing the effort.

2.8 Demonstrate knowledge of the factors that should be considered in evaluating the findings/recommendations obtained from front-end analysis data.

STANDARD

Factors to be considered include:

- Evaluation of the methods of obtaining target population entry level characteristics data and the assumptions about the target audience.
- Assurance that established policies and directives were followed in obtaining task analysis/job performance data.
- Evaluation of decisions regarding suitability of formal course versus other methods of meeting job performance requirements.
- Evaluation of the suitability of any existing courses, including assurance that information regarding existing courses is collected and practical considerations in light of training requirements, scheduling, and costs are reviewed.
- Determination of the acceptability of recommendations to include consideration of the following questions:
  - Are recommendations based on adequate data?
  - Were constraints considered?
  - Are recommendations consistent with organizational policies and directives?

3. DEVELOPMENT OF LEARNING OBJECTIVES

3.1 Demonstrate knowledge of the function of learning objectives in SAT-based instruction and their relationship to the job/tasks for which training is being conducted.

STANDARD

A learning objective describes precisely what is to be learned in terms of the expected trainee performance under specified conditions to accepted standards. These learning objectives are often referred to as terminal learning objectives, and are easy to identify because they are similar to the task statements. An example of a task statement and associated terminal learning objective for a mechanical technician job is:

> "Given the disassembled parts of a service water pump, proper tools, and the approved procedure, reassemble the pump in accordance with the steps of the approved procedure."

3.2 Demonstrate the skill to describe/illustrate the behavior component of a learning objective and distinguish among good and poor examples with respect to training development and effective training.

STANDARD

One of the three components of a learning objective is behavior. Listed below are examples of some behaviors (action verbs):

Knowledge

Analyze
Apply
Calculate
Check (visual)
Classify
Derive
Discriminate
Evaluate
Identify
List
Monitor

Name
Prove
Recall
Recite
Relate
Solve
State
Tell
Verify
Write

Skill

Adjust
Assemble
Calibrate
Close
Communicate
Inspect
Open
Operate
Reassemble
Remove

Repair
Replace
Select
Set
Start
Stop
Throttle
Trip
Vent

Examples of these behaviors (actions) are underlined in the learning objectives below:

> Given the disassembled parts of a service water pump, proper tools, and the approved procedures, reassemble the pump in accordance with the steps of the approved procedure.
>
> Given temperature indications and their associated times, calculate the heatup rate with an accuracy of within ±2 degrees per hour.

In general, the behaviors stated in the learning objectives should be the same as those stated in the related tasks/skills/knowledge; however, sometimes there may be differences between these behaviors. For example, if plant safety, potential for equipment damage or other considerations preclude the actual performance of the task in training, the learning objective action statement may be "simulate tripping the auxiliary boiler" when the task action statement is "trip the auxiliary boiler."

Learning objectives related to the job task are generally called terminal learning objectives and there should be (at least) one terminal objective for each task to be trained. Similarly, there should be one learning objective associated with each skill/knowledge supporting (i.e., enabling) satisfactory task performance. These learning objectives are often referred to as enabling learning objectives.

3.3 Demonstrate the skill to describe/illustrate the condition component of a learning objective and distinguish among good and poor examples with respect to training development and effective training.

STANDARD

The condition portion of a learning objective states the conditions under which the learning task (objective) is to be performed. In general they should not mix learning outcomes with the process of learning (see objective 1.6 on page 3-10), they should not omit significant information nor provide information of little significance, nor should they describe the mechanics of learning task performance evaluation instead of conditions. Examples of conditions are underlined in the following learning objectives:

> Given the disassembled parts of a service water pump, proper tools, and the approved procedure, reassemble the pump in accordance with the steps of the approved procedure.
>
> Given temperature indications and their associated times, calculate the heatup rate with an accuracy of within ±2 degrees per hour.

3.4 Demonstrate the skill to describe/illustrate the standard component of a learning objective and identify acceptable examples with respect to training development and effective training.

STANDARD

The standard portion of a learning objective states the criterion(a) for satisfactory task performance. The standards should be objective, measurable, and complete. They can refer to external authority, express or imply a ratio, specify physical measurements or tolerances, specify time requirements or a rate of production, specify degrees of supervision or assistance, or specify qualitative requirements. Good examples of standards are underlined in the following learning objectives:

> Given the disassembled parts of a service water pump, proper tools, and the approved procedure, reassemble the pump in accordance with the steps of the approved procedure.
>
> Given temperature indications and their associated times, calculate the heatup rate with an accuracy of within ±2 degrees per hour.

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3.5 Demonstrate the skill to develop learning objectives in sufficient detail to support training development and effective training.

STANDARD

The information given in the learning objectives must be sufficient to provide the basis for training program development. Examples of learning objectives that are not sufficiently detailed are:

"Solve basic mathematics problems" and

"Operate plant equipment."

Neither of these objectives is specific enough to allow even identification of meaningful conditions or standards.

In contrast, learning objectives should provide the instructional designer with the information necessary to organize objectives, select instructional settings, and other related actions required to design and develop a training program. Here are two examples of good learning objectives:

"Given a handheld calculator, calculate the volume of a cylinder, without error" and

"When directed by the shift supervisor and given the appropriate procedure, start a main feedwater pump in accordance with the appropriate procedure."

3.6 Demonstrate knowledge of the relationship between learning objectives and job performance.

STANDARD

Generally, the process of developing learning objectives begins with the analysis of a job into its component tasks, including a determination of the conditions under which that task is performed and standard(s) for acceptable task performance. This information is translated into a criterion objective (or job performance measure). These are then translated into terminal learning objectives. The terminal objectives are the learning outcomes, the behavior that is desired as a result of instruction. Having achieved these learning outcomes, the instructor is reasonably assured that the trainee is equipped to perform adequately in the job context. During instructional development, the terminal objectives are often analyzed further into enabling objectives based on skills and knowledge requisite to adequate task performance.

3.7 Demonstrate knowledge of the rationale for the use of learning objectives in structuring an effective program of instruction.

STANDARD

The rationale should include the following important functions of learning objectives:

- Serve as a guide and target for the trainee delineating what the trainee will be able to do at the end of instruction, the conditions under which it will be done, and how well it must be done.
- Provide objective feedback on performance to the trainee.
- Provide the instructor with an objective determination of the trainee's progress and an indication of when the trainee has achieved the objective.
- Provide the basis for systematic structuring and sequencing of instruction, selection of the appropriate methods, media, and environment, and evaluation of the program.

4. INSTRUCTIONAL DESIGN AND IMPLEMENTATION

4.1 Demonstrate knowledge of the necessary elements of an organizational plan that governs SAT-based instructional development and implementation.

STANDARD

A training program organizational management plan should fulfill the following functions:

- Clearly delineate the assignment and definition of training program management, administration, instructor, and support responsibilities.
- Delineate the trainee management strategy, including program entry and completion criteria, and procedures for identifying/controlling marginal trainees (see also item 5.2).
- Specify instructional facilities (e.g., building, classroom, laboratory, equipment) and instructional media requirements.
- Specify the training schedule for both initial training and periodic retraining.
- Delineate trainee record requirements and periodic retraining.
- Specify the training program evaluation plan (see also items 5.2 through 5.7).

4.2 Demonstrate knowledge of the principles governing the organization of instruction.

STANDARD

Learning objectives may be dependent on, independent of, or complementary to one another. When one objective depends on another, the dependent objective should be taught after the objective upon which it is dependent. Complementary objectives should be grouped together. An example of a dependent relationship would be that recognition of abnormal operation of a pump first requires knowledge of the indicators of normal pump operation. An example of a complementary relationship would be assembly and disassembly of a centrifugal pump.

4.3 Demonstrate knowledge of the principal characteristics of a lesson plan and the key elements underlying its development/use.

STANDARD

A lesson plan is a structured outline that ensures consistency in instructor presentation and evaluation of trainee performance. Regardless of the instructional setting (classroom, laboratory, OJT, simulator, or self-study), lesson plans should include:

- Learning objectives,
- Appropriate instructor teaching activities,
- Instructor and trainee references,
- Appropriate evaluation methods/standards, and
- Required materials (audiovisual aids, test equipment, etc.).

For formal OJT, lesson plans frequently are a series of OJT guides. These guides provide guidance and structure during training in the plant. They can also be used as qualification guides or checklists to evaluate a trainee's skill in performing a task.

For simulator training, the lesson plan may be an exercise guide and should include:

- Indications/symptoms to be recognized,
- Correct responses to the exercise,
- Standards for objectively evaluating trainee performance, and
- Feedback to be provided to the trainee.

4.4 Demonstrate skill in using a systematic procedure for selecting instructional methods/media/settings appropriate to the learning objectives/course of instruction under development.

STANDARD

An instructional setting is the environment in which learning occurs. The job performance requirements must be considered in selecting the appropriate instructional setting. For example, it would not be appropriate to select a classroom as the instructional setting for a learning objective that requires a "hands-on" environment for mastery. Shown below are some characteristics used to select instructional settings:

INSTRUCTIONAL SETTING	SOME REASONS FOR USE	SOME REASONS NOT TO USE
Classroom	Large group of trainees can be scheduled at the same time Large amount of information is to be presented	Hands-on environment is required for mastery
Laboratory and Workshop Instruction	Hands-on environment required and necessary conditions can be provided in the laboratory	Necessary conditions cannot be provided/simulated in the laboratory
Formal OJT	Hands-on environment required and necessary conditions/equipment operation can be provided in the plant Sufficient qualified personnel are available to conduct the OJT	Necessary conditions cannot safely be provided/simulated in the plant Plant status/safety does not permit manipulation of the equipment
Simulator Instruction	High fidelity to the job task is required to allow trainee mastery	Necessary conditions can be provided in a less costly setting
Self-Study	All conditions can be contained in the training material (or made available in the plant)	Close supervision required to prevent injury or damage to the plant equipment Task is identified as difficult to learn/perform

4.5 Demonstrate skill in using entry level skills, knowledge, and learning objectives in evaluating appropriateness of existing instructional material.

STANDARD

In many cases, existing instructional materials may be used (either "as is" or with modification) for implementing a performance-based training program. Among these cases are:

- o If the training program has been in place for some time before a systematic analysis of job performance requirements is performed, the licensee may choose to revise the existing training materials (as required) rather than develop new materials.
- o A training program is being developed for a job that is "similar" to another job where performance-based training materials (based upon the other job) are available.

The use of these existing materials (or their modification for use) in a performance-based training program is entirely appropriate _if_ the decision to use these materials is based upon job performance requirements (e.g., the learning objectives) and trainee entry-level skills and knowledge. If existing training materials are used, there should be documentation available that indicates a review of these materials was conducted that included the following criteria:

- o Is the material content and reading level consistent with expected entry-level skills and knowledge?
- o Does the material adequately address the learning objectives?
- o Is the material consistent with other components of the training program?

4.6 Demonstrate skill in using various lecture methods, illustrating the advantages and disadvantages of each.

STANDARD

The teaching lecture is a formal or informal presentation of information, concepts, or principles by a single individual.

The formal lecture is usually given to large groups with no active participation by the trainee. The learning experience is essentially passive.

In the informal lecture, the size of the group is usually smaller than in the formal lecture and allows interaction between the instructor and trainees.

A briefing is a formal or informal presentation in which a variety of significant facts is presented as concisely as possible. The briefing is rarely concerned with material beyond the knowledge level and is almost always accompanied by visual aids.

A guest lecture is a presentation by a person other than the instructor who is usually an expert. It is used to give variety to the class period or to supply information in an area where the instructor is not an expert.

Advantages of Lectures

- Most efficient method for presenting many facts/ideas in short time.
- Particularly suitable for introducing a subject (i.e., a survey).
- Convenient for instructing large groups.
- Often useful to supplement material from other sources or for information difficult to obtain by alternative means.
- Allows a large number of trainees to receive information from qualified subject matter experts.

Disadvantages of Lectures

- Essentially passive; little opportunity for trainee participation.
- Difficult for instructor to estimate trainee progress prior to examination, etc.
- Too much instructor preparation time.
- Difficult to hold trainee attention for entire lecture period.

4.7 Demonstrate skill in using various indirect methods of discourse.

STANDARD

Indirect discourse involves verbal interaction among two or more persons that is seen and heard by trainees. Some examples include:

1. A dialogue is interaction between two or more persons, one of whom may be the instructor, generally to present sharply opposing points of view for trainees. The dialogue is often highly structured towards preplanned goals and may take the form of questions and answers between the participants.

2. In a teaching interview, the instructor questions a visiting expert and follows a highly structured plan that leads to educational objectives. The advantage of the teaching interview over the guest lecture is that the instructor controls the expert's presentation. The expert normally requires little or no advance preparation, but responds impromptu from general experience. When a question-and-answer period follows the interview, trainees can interact with the expert.

3. A panel is a structured or unstructured discussion between two or more experts (generally excluding the regular instructor), presented in a variety of ways such as constructive arguments followed by debate, and response to questions from the trainees.

4.8 Demonstrate skill in using various demonstration-performance methods.

STANDARD

The demonstration-performance is the presentation or portrayal of a sequence of events to show a procedure, a technique, or an operation, frequently combining oral explanation with the operation or handling of systems, equipment or material.

Coaching is an intensive learning experience for an individual or for small groups, characterized by significant trainee involvement and immediate instructor feedback. A videotape of trainee performance is an excellent teaching aid when supplemented by an instructor's analysis and critique. This technique is particularly effective in instructor training.

Tutoring is an informal, trainee-centered activity generally involving instructor and trainee in a one-to-one relationship, often for remedial reasons or for trainees with special needs.

4.9 Demonstrate skill in using various self-paced instructional methods.

STANDARD

Self-paced instruction is a learning program organized so that trainees may move through it at their own pace under the guidance of an instructor. Some typical applications:

1. Programmed instruction usually includes a carefully planned sequence of small units of instruction that require the trainee to respond to cues and receive immediate feedback. Various media (books, teaching machines, and computers) are used to deliver the programmed instruction to the trainee.

2. Modular instruction contains prepackaged units of instruction that typically contain a clear statement of objectives and all necessary learning resources to permit the trainee to achieve these objectives. A module can be a complete unit or part of a course.

3. Computer-assisted instruction uses a computer as the vehicle for interaction between the trainee and the planned course of instruction.

4. Mediated instruction uses such devices as slides, films, tapes and cassettes to present the planned course of instruction to the trainee.

4.10 Demonstrate skill in using various questioning methods.

STANDARD

Questioning as a method is used to emphasize a point, stimulate thinking, keep trainees alert, check understanding, review material, and seek clarification. Examples of this method are:

1. The Socratic method may resemble a guided discussion, but the goal is often to obtain specific answers to specific questions (reiteration) and not to stimulate discussion. An instructor may use the method for "trapping" trainees into logical inconsistencies which sharpen their thinking skills.

2. The student query method ("trainees asking questions") is often used in combination with other methods, such as the lecture, the panel discussion, or the teaching interview, but it could be used by itself, either on a one-to-one basis in tutoring or coaching or as part of small or large groups. The method is trainee controlled, although the respondent can also control the session to a certain extent if skillful enough. Trainees' questions may often be a measure of the degree of their understanding of a particular matter, that is, "they know enough to ask the right questions."

4.11 Demonstrate skill in using various nondirected and guided discussion techniques.

STANDARD

Nondirected discussion is a group interactive process in which task- or objective-related information and experiences are evoked from the trainee. The instructor normally plays a very limited or passive role. For example:

1. The peer-controlled seminar is a group of highly qualified peers who meet periodically for the exchange of ideas. A qualified trainee often acts as a "facilitator" to lead discussions or conduct workshops. The instructor should provide a statement of the educational objectives, a suggested discussion guide, and should require some tangible evidence of the results of the discussion.

2. Free discussion (akin to the "bull session") can be a valuable adjunct to participatory management or brainstorming, but it seldom supports measurable objectives.

The guided discussion is an instructor-controlled, interactive process of sharing information and experiences related to achieving an educational objective. The instructor interacts with the group as a whole through questions but tries not to dominate the discussion. Trainees are encouraged to learn about a subject by actively sharing ideas, knowledge, and opinions. The method employs inductive learning to help trainees form generalizations.

4.12 Demonstrate skill in using the case study method.

STANDARD

The case study is a learning experience in which trainees encounter a real-life situation in order to achieve some learning objective. By studying realistic cases in the classroom, trainees develop new insights into the solution of specific on-the-job problems and also acquire knowledge of the latest concepts and principles used in problem solving.

4.13 Demonstrate skill in using various simulations.

STANDARD

Simulations are low-risk, educational experiences that substitute for some real-life situation. Simulations may involve individuals, groups, or whole units. They may preempt normal classroom time, and they are especially effective as capstone methods following a block or several blocks of instruction. Some kinds of simulations are:

1. Role playing requires trainees to project themselves into a simulated interpersonal situation and play the parts of the persons and situations assigned by the instructor. Role playing is generally limited to practice of the skills involved in interpersonal relations, such as counseling, interviewing, and conference leadership.
2. In-basket exercises simulate (in random order) a series of matters or decisions that a leader might actually encounter. Trainees are confronted with a rush situation, limited information, and a list of action-demanding items that actually might be found in an in-basket. After sorting out priorities, trainees dispose of matters by indicating the appropriate actions to be taken.
3. In organizational or management games, trainees manipulate an organization or some component part to try to produce certain outcomes.
4. In hardware simulation, trainees use trainers that resemble the equipment that is to be used on the job. Such devices are substituted when using the actual equipment is too costly or otherwise impractical.

4.14 Demonstrate skill in using on-the-job training methods describing the key characteristics, advantages, and disadvantages of their use.

STANDARD

On-the-job training (OJT) is intended to enhance knowledge and skills that have been learned initially in a formal course. It is aimed at bringing to complete proficiency a particular skill (or set of skills) by practicing the skill under supervision. To be maximally effective OJT should be organized in accordance with a well-defined set of learning objectives that define the conditions and standards of acceptable performance. OJT is often indicated when only experience and practice in the task will bring the trainee to a level of knowledge and skill demanded by the performance, but the associated equipment and facilities (e.g., a simulator) are not available in the learning situation. This is particularly true of operational tasks. Unfortunately, OJT sometimes becomes a "catch all" for training tasks that are perceived as too difficult using alternative means.

4.15 Demonstrate knowledge of the various classes of visual aids and instructional media.

STANDARD

The different types of visual aids and instructional media available for use in the instructional context are virtually unlimited. The list is constantly changing as technologically older media are supplanted by newer ones. A general listing of the classes into which such media can be organized follows:

Chalkboards (flannel boards, bulletin boards),

Flat pictures,

Charts, diagrams, and graphs,

Models, mockups, and cutaways,

Simulations and simulators,

Overhead transparencies,

Still projectors (opaque, filmstrip, and slide),

Motion pictures,

Audio tape recorders and recordings (including compressed speech),

Television, video tape recorders and recordings,

Programmed instructional media (textbooks, etc.), and

Computer-based media (computer assisted instruction, instructive video discs, computer-managed instruction).

4.16 Demonstrate skill in using the process of visual aid/instructional medium/ instructional setting selection in support of instruction.

STANDARD

Ideally, the type of aid, medium, or setting should be determined by the lesson objective. For example, if a learning outcome requires trainees to identify or recognize an item or process, the instructor should select a medium that visually displays the item or process. Next, the best form of visual aid, instructional medium, or setting is determined by asking the following questions:

- Must the actual item or process be seen or will a replica do as well?
- Is motion required?
- Will a large number of trainees view the visual aid at the same time and place or will time and location vary?
- Have existing aids been surveyed to determine whether the required materials are already available?
- Is the equipment available to display the visual aid?

The answers to these questions frequently will involve trade-offs. For example, the cost of producing a color film may be prohibitive, or a closed circuit television system may not be available. Because the availability of equipment and material may dictate the teaching method selected, it is important to combine the method and media selection process. When a long lead time or budget limitation is involved, the media selection process may have to occur very early in the instructional system development process.

4.17 Demonstrate knowledge of the effects of individual trainee differences and small group dynamics on the conduct of instruction and why they must be addressed in an effective instruction design.

STANDARD

A satisfactory response will include consideration of the following:

- Differences among trainees complicate the instructor's task.
- Differences among trainees can be addressed by adopting the instructional system or by admitting only those trainees who will most probably succeed.
- Instructors should avoid making stereotypes and use caution in interpreting group averages.
- Trainees vary in their motivation and numerous techniques exist for motivating trainees.
- Differences in classroom ability may be met by such means as independent and self-directed study, contracting, mastery learning, and by personalizing instruction.
- In small learning groups, both the subject matter and the interaction among group members must be considered.
- Nonproductive trainees (e.g., arguer, nonparticipant, and clown) and group problems (e.g., apathy and hostility) should be dealt with by the instructor.

4.18 Demonstrate knowledge of the elements of a plan for the design, development, and implementation of an instructional system, program, or unit of instruction.

STANDARD

A satisfactory plan will specify:

- Personnel requirements including the number and qualifications of personnel required, from what sources (internal, staff, external) they can be obtained, and what organizational support they will require.
- Sources for the appropriate data such as the results of previous generic industry and plant-specific analysis, operating procedures, other engineering documentation (technical manuals, etc.), and previous or similar course documentation.
- Estimated milestones for specific stages of the effort (development, implementation, maintenance) including considerations of staff availability, work assignments, assignment workload, and schedule.
- Procedures and guidelines to be used in completing the effort.

4.19 Demonstrate knowledge of the elements of a plan for the development of validation procedures for a specific unit of instruction.

STANDARD

A satisfactory plan will specify:

- Validation constraints such as time, personnel, budget, facilities and equipment, and policy.
- Resource requirements such as facilities, time, personnel, etc.
- The target audience for validation.
- Procedure(s) for review and analysis of validation results and subsequent revision of instructional materials, content, and/or design.

4.20 Demonstrate knowledge of the elements of a plan for the implementation of a unit of instruction.

STANDARD

A satisfactory plan will specify:

- Personnel requirements including numbers and qualifications of support as well as instructor personnel.
- Facility and equipment requirements and scheduling.
- Guidelines for conduct of instruction including performance feedback, safety precautions (as appropriate), and handling of student critiques.
- Trainee recordkeeping requirements.
- Detailed schedule for the conduct of instruction.

4.21 Demonstrate knowledge of the factors that should be considered in evaluating the development of training documents and materials for a specific unit of instruction.

STANDARD

Factors to be considered include:

- A review of the tasks and a correlation between tasks, objectives, and test items.
- Assurance that established policies and directives were followed in development activities.
- Determination of the acceptability of recommendations to include consideration of the following questions:
  - Are recommendations based on adequate data?
  - Were constraints considered?
  - Are recommendations consistent with organizational policies and directives?
- Review decisions concerning any recommended contingency plans.

4.22 Demonstrate knowledge of the factors that should be considered in evaluating the validation findings/recommendations for SAT application to a specific unit of instruction.

STANDARD

Factors to be considered include:

- Evaluation of the methods of obtaining the validation data and the analysis of the results.
- Assurance that established policies and directives were followed in obtaining the validation data.
- Determination of the acceptability of recommendations including consideration of the following questions:
  - Are recommendations based on adequate data?
  - Were constraints considered?
  - Are recommendations consistent with organizational policies and directives?

4.23 Demonstrate knowledge of the principal elements of an effective instructional program management plan.

STANDARD

The principal sign of effective instructional program management support is the existence of a training program "master" plan which clearly documents functions, procedures, and responsibilities. Among the areas that this plan should address are the following:

1. Successful execution of a training program depends on:
   - o Thorough understanding of the training content and
   - o Additional skills and knowledge in the areas of:
     - Training program development (represented by the training professional),
     - Instruction (represented by the qualified instructor), and
     - Management (represented by the management professional with a training background).
2. Training staff qualifications should also address each of these three additional skill/knowledge areas (training program development, instruction, and management).
3. Specialized skills and knowledge are required in analyzing jobs and tasks, developing learning objectives, and selecting appropriate instructional settings, methods, and media, etc.
4. Training personnel must possess the requisite skills and knowledge that are normally acquired through specialized training and practical experience. The program should provide for the periodic, objective evaluation of each staff member's performance, and for both initial and continuing training.
5. Developing and maintaining effective and relevent training programs requires considerable non-classroom time. In addition, the failure to provide sufficient time for preparation, technical skill maintenance, and professional development will reduce the quality of instruction. Staffing levels should be maintained to allow for these needs.

5. TRAINEE EVALUATION

5.1 Demonstrate skill in systematically developing materials/procedures to evaluate assumed trainee entry-level skills/knowledge, in-course trainee performance, and end-of-course achievement.

STANDARD

For task level learning objectives (i.e., terminal learning objectives or TLO's), the actual behavior called for in the task statement and TLO should also be required for the performance test (i.e., the test should assess the task as it is stated).

For learning objectives that support the TLO's (i.e., enabling learning objectives or ELO's), the test items should be consistent with the action statement, conditions, and standards for the ELO. Written tests are a valuable means of assessing mastery, but they are sometimes selected for convenience rather than appropriateness. Knowledge tasks beginning with verbs, such as explain, differentiate, evaluate, describe, construct, and solve, require tests that involve more than recall of terms and facts.

Any testing system should also make provisions for protecting the test material from compromise.

5.2 Demonstrate skill in using trainee evaluations in governing the management of the training process and the appropriateness of the instructional content.

STANDARD

When administered to all candidates for training, pretest results can be used to:

- o Confirm individual candidate qualifications for entering the training program,
- o Identify remedial training requirements for candidates who do not meet the entry-level requirements. The minimum standards used as the basis for remediation should be based upon job performance requirements.
- o Provide a basis for exempting candidates from all or part of the training program.

5.3 Demonstrate skill in using trainee evaluation in providing trainee performance feedback.

STANDARD

Elements of trainee evaluation include:

- o Comprehensive tests, developed and scored to measure mastery of skills required for job performance, ensure that only competent trainees successfully complete the program.
- o Performance tests should include only essential items and should require the trainee to master these to be considered competent.
- o For written tests, criteria derived from industry standards/regulations and plant-specific requirements based on performance objectives should be used to determine the level of mastery of program content.

Tests provide the trainees with feedback with respect to their performance. Aspects of feedback include:

- o Feedback should be immediate and continuous.
- o Feedback can be provided by self-checks in workbooks or by instructor-administered tests.
- o Test results should be provided promptly to the trainees (within a day or week).

5.4 Demonstrate skill in distinguishing criterion-referenced evaluation methods from normative testing methods, and demonstrate skill in using criterion-referenced evaluation methods.

STANDARD

Tests measure how well trainees meet the instructional objectives.

A criterion-referenced test (CRT) (whether given before, during, or after instruction) measures carefully written measurable objectives.

In normative testing, tests and test data are used to rank, order, or compare trainees to each other.

No other use of test data should interfere with the need to compare what trainees can do to what they ought to be able to do, as described by the instructional objectives.

5.5 Demonstrate knowledge of the elements of a plan for the development of testing procedures for a specific unit of instruction.

STANDARD

A satisfactory plan will specify:

- Personnel requirements for the development of and administration of the testing procedures and materials.
- Testing resource and time requirements (facilities, simulator time, etc.).
- Integration of testing with instruction and within overall program.
- Measures for test security.

6.1 Demonstrate skill in the use of a systematic method for maintaining training content current once instruction is in place.

STANDARD

Job performance requirements may change over time for a variety of reasons, such as:

- Backfits/modifications of plant equipment,
- Changes in plant operating or administrative procedures,
- Lessons learned through operating experience, and
- Reorganization or changes in job responsibilities.

If training is to remain performance based, then the impact of these changes must be analyzed and the training program revised, as required. Procedures for accomplishing this should be in the facility's training plan, administrative procedures or related documentation.

6.2 Demonstrate skill in relating the evaluation of trainee performance to other aspects of the training program.

STANDARD

Just as individual trainee test performance is indicative of the strengths and weaknesses of individual trainees, review of the aggregate test performance of trainees provides insights into the strengths and weaknesses of the training program. While the identification of areas where trainees had difficulty in meeting program standards is straightforward, the determination of the cause of these difficulties may not be. There is a tendency to focus on a solution of "more training"; however, the analysis should also consider:

1. The adequacy of the procedures or other job performance aids provided,
2. The adequacy of selection criteria,
3. The sequencing of training (is prerequisite training being provided?), and
4. The qualifications and performance of the instructor.

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6.3 Demonstrate skill in identifying problems associated with the training materials.

STANDARD

Instructors are in a unique position to identify problems with the technical accuracy, completeness, sequencing, and trainee difficulties associated with the training materials. These problems should be identified as they occur through a diary, log, or similar means. Recommended changes should be reviewed in a timely manner and implemented as appropriate.

Information provided by trainees upon completion of major segments of training should focus on course effectiveness and ways to improve training. To be most effective, the critiques should:

- Be in written form and
- Be structured to focus trainee comments on the desired information.

6.4 Demonstrate skill in obtaining and utilizing training program information from recent graduates and job incumbents.

STANDARD

Soliciting information from program graduates three to six months after they complete training can aid in identifying strengths and weaknesses of initial training programs. Information from more experienced job incumbents should also be collected to identify needs for continuing (refresher) training. The following types of information should be collected:

1. Unexpected difficulties in performing tasks on the job,
2. Tasks that are particularly difficult or easy to perform,
3. Differences between the way tasks are performed on the job and the way they are taught,
4. Additional training needed to do the job, and
5. Kinds of errors committed on the job.

6.5 Demonstrate skill in obtaining and utilizing training program information obtained from supervisors.

STANDARD

Information should be solicited periodically from supervisors (annually is suggested) to determine how well the initial training program is preparing individuals to perform their jobs and what continuing training is needed for current job incumbents. The following types of information are relevant:

1. Tasks for which new job incumbents are inadequately prepared,
2. Kinds of errors being committed by job incumbents,
3. Additional training received by new job incumbents once they are on the job,
4. Suggestions for improvements in initial and continuing training programs, and
5. Expected changes in job assignments, procedures, or equipment.

6.6 Demonstrate skill in obtaining and utilizing training program information based on on-the-job performance reports and problems.

STANDARD

An analysis of on-the-job performance problems should be based on a systematic method of collecting the necessary information, such as:

- LER's,
- Industrial accident reports, and
- Plant events, resulting from personnel errors, not requiring LER's (i.e., equipment damage, unscheduled maintenance, outage extensions).

Much of this information may be available in written reports; however, often there is a reluctance to document personnel errors because of concern about the effect on the individual. For this reason, there is often a need to supplement the information in written reports with interviews of supervisors and engineers.

In analyzing the information for training implications, two common problems arise:

- The general assumption that additional training is the solution to all personnel errors. The analysis should consider other potential solutions also, e.g., procedure changes, work design/workloads, equipment design changes, and level of supervision.
- The root causes of human performance problems are not identified. For example, a pattern of corrective actions that state, "remedial training was provided to the individual(s) involved," may be indicative that only a cursory analysis of the cause of the problem has been performed.

An adequate training program is a necessary, but not sufficient, condition for satisfactory on-the-job performance; that is, if training is inadequate, then on-the-job performance will be less than satisfactory. However, unsatisfactory job performance is not always the result of an inadequate training program. The training may be adequate and other factors may be at fault, such as:

- Inadequate supervision,
- Poor procedures, or
- Lack of motivation.

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6.7 Demonstrate knowledge of performance feedback in the training context.

STANDARD

In the classroom, feedback is defined as information trainees receive from their instructor about their performance which will cause them to take self-corrective action and guide them in attaining the goals of the course more effectively. Trainees receive feedback from at least five sources: the self, the learning task, fellow trainees, the instructor, and the school. Feedback generally serves one or two purposes:

- Informational (for correcting errors the trainee commits) and
- Motivational (to make the trainee try harder).

6.8 Demonstrate knowledge of the essential characteristics of effective feedback.

STANDARD

The essential characteristics of effective feedback are:

- Effective feedback is objective and focuses on the trainee and trainee performance.
- Trainees must develop confidence in the instructor before they can willingly accept feedback.
- Feedback is pointless unless the trainee profits from it, either by increased self-esteem or motivation, or by indication of the direction for improvement or urging to a higher level of improvement.
- Instructors should be flexible in giving feedback and should vary the method, organization, and content of the feedback to suit the trainee or the situation.
- Feedback should follow some form of organization, previously explained to the trainee.
- Effective comprehensive feedback should include both strengths and weaknesses. Specific examples should be given. The trainees should be aware of what they did well and how they can improve.

6.9 Demonstrate knowledge of and skill in using the various methods of providing performance feedback.

STANDARD

Performance feedback can be provided in several ways:

- o Group Critiques. Feedback is given in a general class session so that more aspects of the subject can be covered.
- o Written Feedback. The instructor devotes more care to preparing written feedback and the trainee has a permanent record for reference. Rating scales can be used.
- o Self-Evaluation. Trainees are encouraged to develop enough confidence to be self-critical. The instructor should follow up to be sure feedback is complete and accurate.

6.10 Demonstrate knowledge of the principal guidelines governing the use of feedback.

STANDARD

The following guidelines aid in providing feedback:

- Establish and maintain rapport with the trainees.
- Tell the trainees the organizational pattern to be used in the feedback.
- Cover the major strengths and weaknesses. Try to be specific and give examples if possible.
- Avoid trying to cover everything. A few well made points may be more beneficial than numerous but inadequately developed points.
- Do not extend feedback beyond its scheduled time. A point of diminishing returns can be reached quickly.
- Allow time for a summary of the feedback to reemphasize the most important things that a trainee should remember.
- Try to avoid comments with "never" or "always"; most rules have exceptions.
- Do not criticize something that cannot be corrected.
- Do not criticize when you cannot suggest an improvement.
- If the feedback is honest, objective, constructive, and supported, no defense should be necessary.
- If part of the feedback is written, it should be consistent with oral feedback.

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6.11 Demonstrate knowledge of the elements of a plan for the internal evaluation of a unit of instruction.

STANDARD

A satisfactory plan will specify:

- Evaluation constraints related to time, personnel, budget, facilities and equipment, and policy.
- Personnel requirements including the number and qualifications of personnel conducting the evaluation (exclusive of the instructors).
- Measures for evaluator preparation/training.
- Evaluation schedule.

6.12 Demonstrate knowledge of the elements of a plan for the external evaluation of a unit of instruction.

STANDARD

A satisfactory plan will specify:

- o Evaluation constraints related to time, personnel, budget, facilities and equipment, and policy.
- o Type of external evaluation to be conducted (e.g., questionnaire, field visits, job performance evaluations).
- o Identification of target population for external evaluation.
- o Resource requirements.
- o Personnel requirements including the number and qualifications of personnel conducting the evaluation (exclusive of the instructors).
- o Measures for evaluator preparation/training.
- o Evaluation schedule.

6.13 Demonstrate knowledge of factors that could result in training deficiencies requiring course revision.

STANDARD

Factors that could result in a deficiency include:

- Insufficient guidelines for course implementation,
- Improper instructional design,
- Improper use of training materials, equipment or facilities,
- Evaluation instruments that do not adequately measure the objectives,
- Outdated materials,
- Insufficient lesson plans, and
- Poor instructor performance (lack of training, knowledge, presentation abilities).

CHAPTER IV

USES OF THE INSTRUCTIONAL SKILLS OBJECTIVES

IV.1 INTRODUCTION

In order to improve or maintain the quality of performance-based training programs, it is important to regularly review the training and qualifications of instructional staff and the ability of this staff to successfully implement the necessary skills. The instructional skills objectives presented in Chapter III should be used as the basis for the following activities:

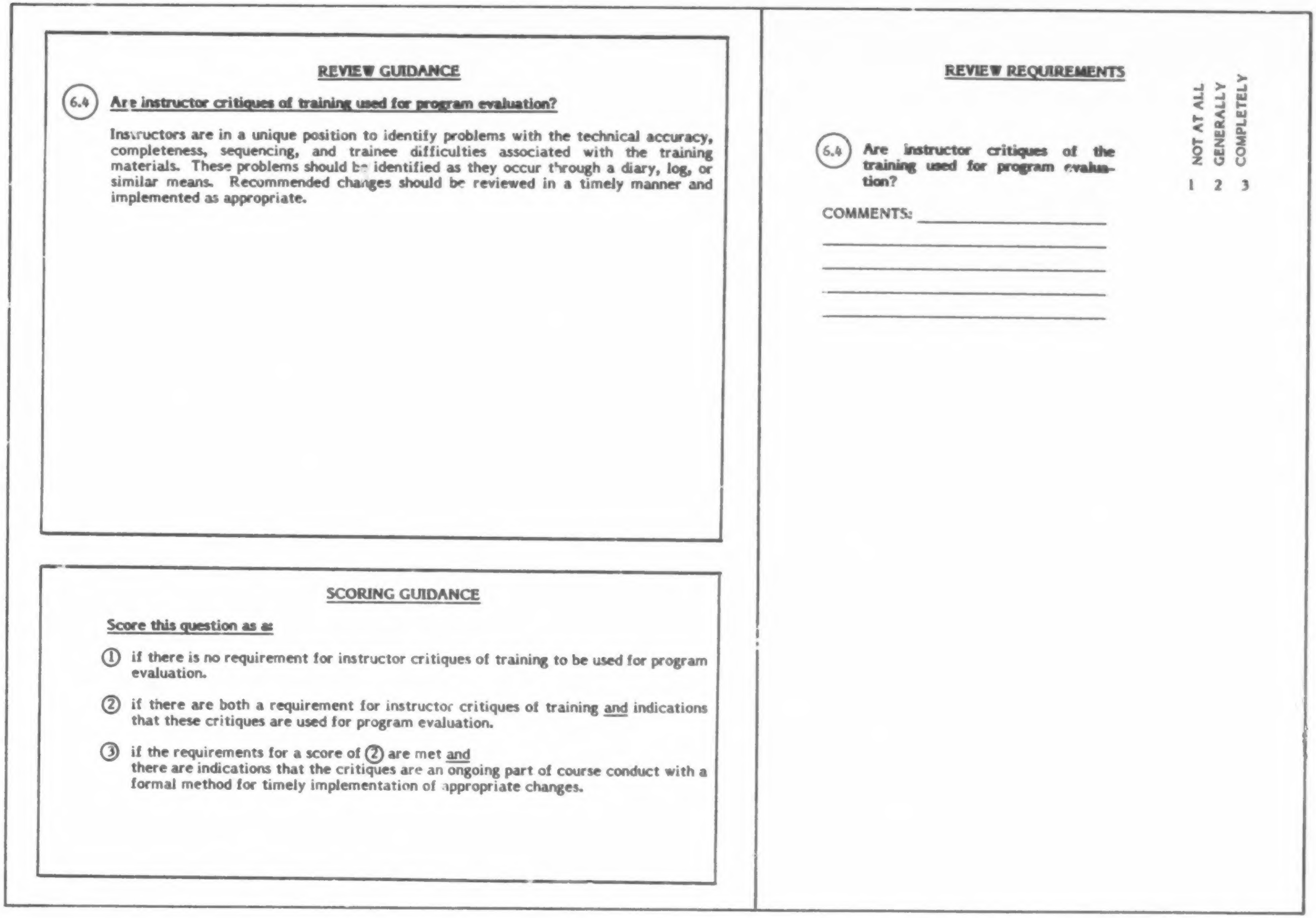
- Conducting reviews of training for instructional staff,
- Developing criterion-tests for evaluation of instructional staff qualifications, and
- Conducting objective reviews of the performance and work products of instructional staff members implementing performance-based training programs.

This chapter provides examples of how the Chapter III instructional skills objectives could be used for each of the above applications.

IV.2 REVIEW OF PROGRAMS FOR TRAINING INSTRUCTIONAL STAFF

Figure 2 shows an example of a recommended training review checklist format. The checklist was developed based upon instructional skills objective 6.4 (see Chapter III, page III-66). It provides an objective and consistent means of determining whether the program for training instructional staff has fulfilled this objective.

To develop similar checklists for review of staff training and qualification, the instructional skills objectives in Chapter III should first be reviewed to determine which of these objectives are applicable to the job(s) being evaluated. Each objective chosen for the review should then be converted to a checklist question such as the one shown in



REVIEW GUIDANCE

(6.4) **Are instructor critiques of training used for program evaluation?**

Instructors are in a unique position to identify problems with the technical accuracy, completeness, sequencing, and trainee difficulties associated with the training materials. These problems should be identified as they occur through a diary, log, or similar means. Recommended changes should be reviewed in a timely manner and implemented as appropriate.

SCORING GUIDANCE

Score this question as a:

① if there is no requirement for instructor critiques of training to be used for program evaluation.

② if there are both a requirement for instructor critiques of training and indications that these critiques are used for program evaluation.

③ if the requirements for a score of ② are met and there are indications that the critiques are an ongoing part of course conduct with a formal method for timely implementation of appropriate changes.

REVIEW REQUIREMENTS

	NOT AT ALL	GENERALLY	COMPLETELY
(6.4) **Are instructor critiques of the training used for program evaluation?**	1	2	3

COMMENTS: ____________________

Figure 2. Example Training Review Checklist Format

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Figure 2. Once this step is completed, the checklist can be used on a regular basis by qualified reviewers to identify weaknesses (if any) in the training and qualification programs.

IV.3 DEVELOPMENT OF CRITERION-TESTS FOR INDIVIDUAL INSTRUCTIONAL POSITIONS

Figure 3 provides an example of the type of criterion-test item that might be developed based upon instructional skills objective 1.5 (Chapter III, page III-9). Tests developed from the objectives provided in Chapter III can be used by instructional staff for self-diagnosis of their skill levels if the answers are provided for their use. It can also be used by the organization for objectively testing for the presence of essential instructional skills.

Criterion-test items such as the example shown (Figure 3) can be used as self-development tools by instructional personnel seeking to improve their instructional skills. They are derived from an analysis of the job and provide objective statements of performance standards. Instructional staff can use these to diagnose their own development needs using these items and follow up by using appropriate self study materials or other resources. This method can lead to avoidance of unnecessary training as well as pinpoint critical developmental needs.

In some environments where performance is critical to health & safety, use of criterion test items can enable the organization to objectively test and evaluate instructional staff. An example of such an environment is the Federal Aviation Adminstration (FAA) where flight instructors must pass a performance-based test before being certified to instruct.

IV.4 REVIEWS OF THE PERFORMANCE AND WORK PRODUCTS OF INSTRUCTIONAL STAFF MEMBERS

Section IV.2 described the use of instructional skills objectives for reviews of instructional staff training programs, while Section IV.3 described the development of

TEST ITEM

1.5 **Select from the following list those items descriptive of various types of mental activity and arrange them according to the associated level of learning by numbering your selections from lowest to highest in the space provided.**

1 = Knowledge
2 = Comprehension
3 = Application
4 = Analysis
5 = Synthesis
6 = Evaluate

Mental Activity

____ Recognition of a specific symptom
____ Select a procedure based on a specific symptom
____ Categorization of a specific event
____ Recall a procedure
____ Determine the probable consequences of an unanticipated event
____ Interpretation of a specific symptom
____ Evaluate probable consequences of a specific event
____ Determine possible courses of action to resolve a specific event

SCORING PROTOCOL

1.5 **Score this item as:**

① if two or fewer correct selections
② if three to five correct selections
③ if six to eight correct selections

_1_ (Knowledge*)
_3_ (Application)
_3_ (Application)
_1_ (Knowledge)
_4_ (Analysis)
_2_ (Comprehension)
_6_ (Evaluate)
_5_ (Synthesis)

***Level of Learning**

Figure 3. Example Criterion-Test

TEST ITEM

(1.5) Match the sample behavioral verbs in List B with the Learning Outcomes in List A by writing the appropriate letter in the space provided.

List A

a. KNOWLEDGE
b. COMPREHENSION
c. APPLICATION
d. ANALYSIS
e. SYNTHESIS
f. EVALUATION

List B

____ name
____ solve
____ relate
____ classify
____ match
____ explain
____ identify
____ judge
____ compute
____ teach
____ create

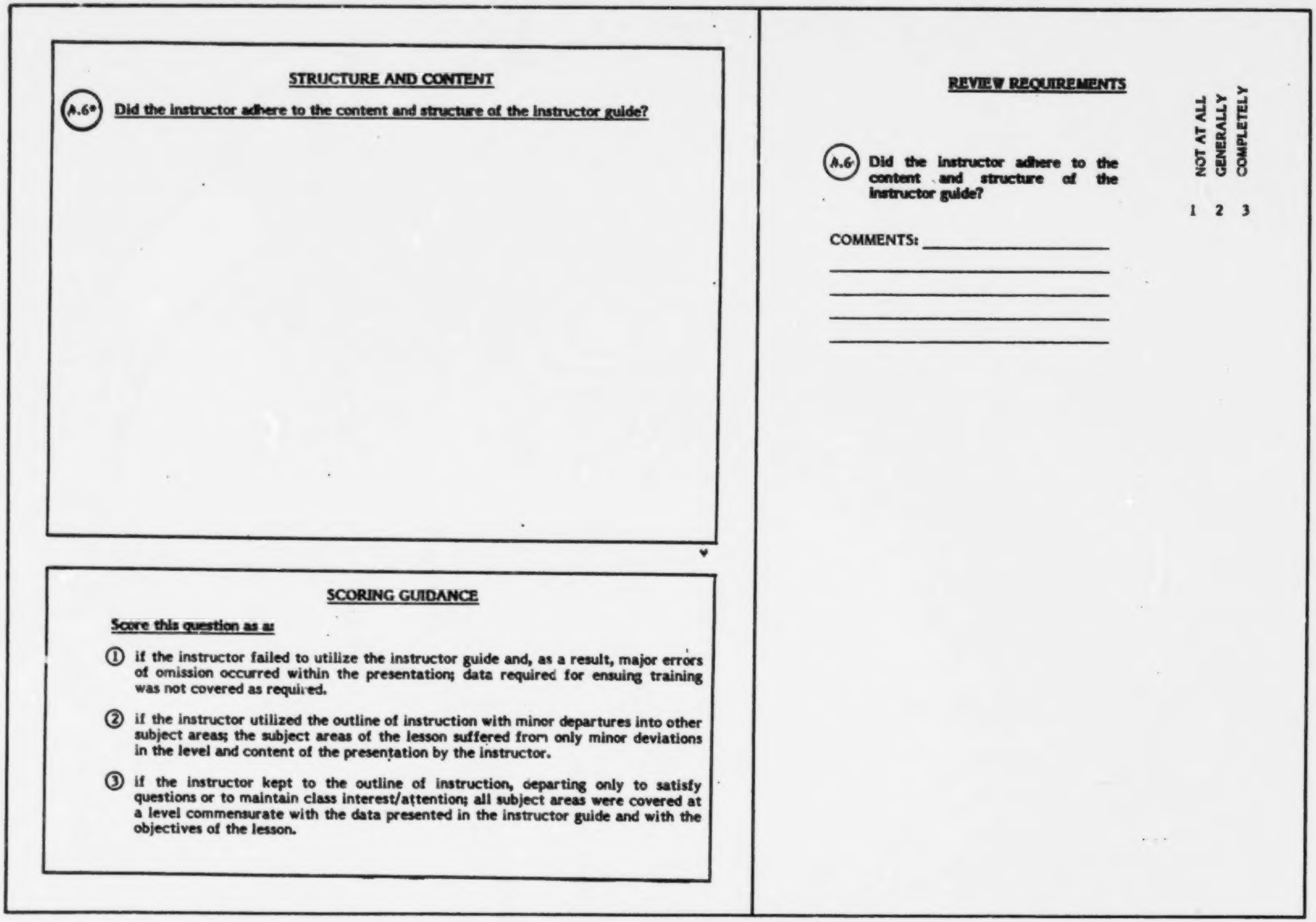
SCORING PROTOCOL

(1.5) Score this item as:

① if three or fewer correct matches
② if four to seven correct matches
③ if eight to eleven correct matches

a	name
c	solve
e	relate
d	classify
a	match
b	explain
b	identify
f	judge
c	compute
c	teach
e	create

Figure 3 (Continued). Example Criterion-Test



STRUCTURE AND CONTENT

(A.6*) Did the instructor adhere to the content and structure of the instructor guide?

SCORING GUIDANCE

Score this question as a:

① if the instructor failed to utilize the instructor guide and, as a result, major errors of omission occurred within the presentation; data required for ensuing training was not covered as required.

② if the instructor utilized the outline of instruction with minor departures into other subject areas; the subject areas of the lesson suffered from only minor deviations in the level and content of the presentation by the instructor.

③ if the instructor kept to the outline of instruction, departing only to satisfy questions or to maintain class interest/attention; all subject areas were covered at a level commensurate with the data presented in the instructor guide and with the objectives of the lesson.

REVIEW REQUIREMENTS

	NOT AT ALL	GENERALLY	COMPLETELY
(A.6) Did the instructor adhere to the content and structure of the instructor guide?	1	2	3

COMMENTS: ____________________

Figure 4. Example Observation Checklist Item

criterion-tests from these objectives. Another effective valid method of evaluating the qualifications of instructional staff members is through observation of the performance of instructional tasks or a review of an individual's work products. The instructional skills objectives in Chapter III can also be used as the basis for objective observations of task performance or reviews of work products. Figure 4 provides an example of one of the observation checklist items that would be developed based upon the instructional skills objective which describes use of lecture methods (objective 4.6, pg. III-38).

All three of the above approaches for evaluating instructional staff qualifications can ensure that instructional staff members have the skills necessary to implement performance-based training. The decision as to which approach to use should at least be based upon the following considerations:

1. Whether enough suitable information is available to use the evaluation approach, and

2. The efficiency of the approach (e.g., resources required).

A program review approach is likely to be the most efficient because an evaluation of all the individuals who completed (or will complete) the training can be conducted through a single review of the training program. This is generally practical only for programs conducted by or for the utility since detailed information (i.e. learning objectives and test items) is required as a basis for the review.

The next most efficient approach will likely be observation/review of work products. However, this approach is only appropriate when relevant work samples or observation opportunities are available.

The criterion-test approach may generally require the greatest expenditure of resources of the three approaches, but it can be used regardless of the availability of information about the programs from which personnel received training or experience.

Based upon the considerations above, the instructional skills objectives in Chapter III have been reviewed and a recommended approach for review of instructional staff members for each instructional skills objective has been identified. These recommendations are based upon what is considered to be a "typical" utility training organization's status with respect to implementation of performance-based training. Therefore the recommendations should be modified based upon an individual utility's status. For example, a utility that conducted training for instructional staff members which addressed the instructional skills objectives 1.1 through 1.12 would be justified in choosing a program review approach rather than the criterion-test approach recommended in Table 3.

TABLE 3

RECOMMENDED METHODS FOR REVIEWS OF INDIVIDUAL INSTRUCTIONAL STAFF MEMBERS

ESSENTIAL ELEMENTS OF A SYSTEMS APPROACH TO TRAINING	RECOMMENDED REVIEW METHOD		
	TRAINING PROGRAM REVIEW	CRITERION-TEST	PERFORMANCE/ WORK PRODUCT REVIEW
1. Overview of a Systems Approach to Training		1.1*, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12	
2. Systematic Analysis of the Job		2.5, 2.6, 2.7, 2.8	2.1, 2.2, 2.3, 2.4
3. Learning Objective Development	3.1, 3.2, 3.3, 3.4, 3.5, 3.6	3.7	
4. Training Design and Implementation		4.1, 4.2, 4.4, 4.5, 4.9, 4.15, 4.16, 4.17, 4.18, 4.19, 4.20, 4.21, 4.22, 4.23	4.3, 4.6, 4.7, 4.8, 4.10, 4.11, 4.12, 4.13, 4.14
5. Trainee Evaluation	5.1, 5.2, 5.3	5.4, 5.5	
6. Program Evaluation		6.2, 6.6, 6.8, 6.11, 6.12, 6.13	6.1, 6.3, 6.4, 6.5, 6.7, 6.9, 6.10

*These are the numbers of the instructional skills objectives in Section III.2

APPENDIX A

DESCRIPTION OF INFORMATION SOURCES

ORGANIZATION

The information sources for this project are described in this document and are organized as follows:

Page

A.1 MILITARY A-5

- A.1.1 United States Air Force (USAF) A-5
- A.1.2 United States Navy (USN) A-9
- A.1.3 Canadian Forces (CF) A-10

A.2 FEDERAL AVIATION ADMINISTRATION (FAA) A-11

A.3 INSTITUTE OF NUCLEAR POWER OPERATIONS (INPO) A-14

A.4 U.S. NUCLEAR REGULATORY COMMISSION (NRC) A-17

A.5 U.S. DEPARTMENT OF ENERGY (DOE) A-19

A.6 NUCLEAR SERVICE COMPANIES/TRAINING MATERIAL VENDORS A-20

- A.6.1 UNC Nuclear Industries A-20
- A.6.2 General Physics Corporation (GPC) A-21
- A.6.3 Memphis State University (MSU)/ Center for Nuclear Studies A-22
- A.6.4 Computer-Based Training (CBT) A-23

A.7 NUCLEAR FACILITY IN-HOUSE PROGRAMS A-23

- A.7.1 Public Service Electric and Gas Company (PSE&G) A-23
- A.7.2 Detroit Edison Company A-24

A.8 ACADEMIC INSTITUTIONS/PROFESSIONAL ORGANIZATIONS A-24

- A.8.1 University of Central Florida (UCF) A-24
- A.8.2 Association for Educational Communications and Technology (AECT) A-27
- A.8.3 American Society for Training and Development (ASTD) A-28

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A.1 MILITARY

A.1.1 United States Air Force (USAF)

(a) The USAF officially adopted Instructional System Development (ISD) in 1970 with the publication of Air Force Manual (AFM) 50-2 (Reference 5). Subsequent policy letters, revisions of AFM 50-2 and Air Force Regulation (AFR) 50-8 (Reference 6) directed that ISD principles and procedures be applied to the managment of all USAF training and development projects.

In evaluating the implementation of ISD in the USAF, studies have focused continually on the training and qualifications of instructional system managers, supervisors, and developers as a principal weakness. In response to this need, in 1983 the USAF Occupational Measurement Center initiated a project to apply ISD to develop training and qualification programs for ISD managers, supervisors, and developers.

While the project is not yet completed, the USAF has made available to the NRC the task inventories, analyses, learning objectives, and criterion tests that have been developed. Of this information, criterion tests are the items of most interest in developing a system for evaluating nuclear facility instructional staff qualifications. The modules for which criterion tests (and learning objectives) have been developed are shown in Table A-1. A representative example of these criterion tests is shown in Figure A-1. This example is taken from the developer module, "Writing Objectives." It is the criterion test related to the enabling objective, "identify components of an objective."

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TABLE A-1

CRITERION TESTS DEVELOPED FOR USAF ISD MANAGERS, SUPERVISORS AND DEVELOPERS

POSITION	MODULES
Senior Managers	1. Overview of the ISD Process 2. Management of the ISD Process
Mid-Level Managers	1. Overview of the ISD Process 2. Resource Management 3. Planning 4. Managing Instructional Development Functions 5. Instructional System Development
Supervisors	1. Overview of the Supervisor's Role in ISD 2. Resource Management 3. Planning 4. Monitoring the ISD Process
Developers	1. Selecting Tasks to Be Trained 2. Principles of Learning 3. Principles of Instructional Design 4. Writing Objectives 5. Performance Analysis 6. Planning Validation and Prescribing Instruction

E.O.#1 Identify components of an objective.

Directions to the Student

Your task on this test:

Identify the components of an objective.

To obtain a passing score:

Identify, with 80 percent accuracy, the components that are stated in each objective.

To complete this task, you are given:

A Response Form containing ten (10) sentences, some of which contain all three components of an objective, some of which are missing one or two components.

RESPONSE FORM

E.O.#1

Directions: Write the letter "A" (for action), "C" (for condition), and "S" (for standard) above the appropriate part of each sentence.

1. The student will be able to type 40 words per minute from a text not seen before,

using standard scoring for time and accuracy.

2. Given the diameter of a sphere and the appropriate formula, compute the surface

area of the sphere.

.
.
.

10. . . .

SCORING KEY

E.O.#1

Directions for Scoring: The student should have written the letter "A" (for action), "C" (for condition), and "S" (for standard) above the parts of each sentence as indicated below. Explanatory comments are given in parentheses. To pass this test and receive a "GO," the student must correctly identify 80 percent of all the components (action, condition, standard) on ten (10) sentences. A score of less than 80 percent will result in a "NO GO".

A C
1. The student will be able to type 40 words per minute from a text not seen before,
S
using standard scoring for time and accuracy.
C A
2. Given the diameter of a sphere and the appropriate formula, compute the surface

area of the sphere. (No standard is stated.)

.
.
.

10. . . .

Figure A-1. Example Criterion Test

(b) While the above information addresses ISD managers, supervisors, and developers, it does not address tasks related to the conduct of instruction. In the USAF, ISD developers are career specialists, while technical instructors are subject matter specialists who are assigned tours of duty as instructors at various USAF Commands and then are rotated back into their subject matter specialty during subsequent assignments. These instructors attend either academic or technical instructor training schools prior to their instructor assignments. An effort has been completed recently to update AFM 50-62, "Handbook for Air Force Instructors" (Reference 7), to a competency-based program. While organized as a handbook rather than in terms of tasks, objectives, etc., the information represents practical guidance for conducting instruction and is directly applicable to this effort. The handbook is well written, detailed, and comprehensive as the outline below indicates.

HANDBOOK FOR AIR FORCE INSTRUCTORS

This training manual presents basic teaching principles and their application in Air Force teacher-learning situations. The text covers an understanding of how people learn and how they communicate. It discusses various teaching methods and technqiues, and ways to evaluate learning and the reasons for such an evaluation. The manual is for instructors engaged in OJT and informal instruction as well as those assigned to Air Force schools.

PART ONE - OVERVIEW

Chapter 1	The Air Force Instructor

PART TWO - LESSON PLANNING

Chapter 2	Learning Theory
Chapter 3	Writing Student-Centered Objectives and Tests
Chapter 4	The Level-of-Learning Lesson Planning Process
Chapter 5	Writing Criterion Objectives
Chapter 6	Developing the Lesson Plan

PART THREE - LESSON DEVELOPMENT

Chapter 7	Developing Knowledge-Level Lessons
Chapter 8	Developing Comprehension-Level Lessons
Chapter 9	Developing Higher Level Cognitive Lessons
Chapter 10	Writing and Measuring Affective Objectives

PART FOUR - INSTRUCTIONAL METHODS AND MEDIA

Chapter 11	Using Questions for Learning

Chapter 12	Survey of Teaching Methods
Chapter 13	The Teaching Lecture Method
Chapter 14	The Guided Discussion Method
Chapter 15	The Case Study Method
Chapter 16	The Teaching Interview Method
Chapter 17	The Demonstration-Performance Method
Chapter 18	Selection of Teaching Methods
Chapter 19	Visual Aids and Instructional Media

PART FIVE - EVALUATION

Chapter 20	Introduction to Evaluation
Chapter 21	Constructing and Administering Classroom Tests
Chapter 22	Measuring Learning Outcomes
Chapter 23	Evaluation by Rating
Chapter 24	Criterion-Referenced Evaluation
Chapter 25	Norm-Referenced Analysis
Chapter 26	Using Feedback in the Classroom

PART SIX - THE STUDENT AS AN INDIVIDUAL

Chapter 27	Student Differences
Chapter 28	The Dynamics of Small Learning Groups
Chapter 29	The Instructor as a Counselor
Chapter 30	Self Concept

A.1.2 United States Navy (USN)

The instructional activities of the USN are nominally governed by the tenets of the Instructional System Development (ISD) model. Unlike the USAF, however, the U. S. Navy ISD does not have the same "official" status as a unitary policy. As a consequence, application of the ISD model varies widely in degree of adherence and emphasis. This variation, in turn, is reflected in the preparation of instructors and instructional developers. The following general observations can be made:

a. Technical and academic instructor preparation are generally controlled by site-specific policy which establishes standards and training. This includes familiarization with the ISD process [e.g., NAVEDTRA 107 (Reference 8), a brief overview of the ISD model as presented in NAVEDTRA 106A (Reference 9) and NAVEDTRA 110A (Reference 3)], material dealing with preparation of instruction by the instructor (e.g., learning objectives, lesson plans and personalization of instruction), and practical training in the more traditional methods of instructional delivery. The specifics of this preparation vary from site to site.

b. No systematic, standardized instruction is provided for operational (i.e., simulator based) training instructors beyond device operation.

c. No systematic, standardized instruction is provided for on-the-job (OJT) instructors beyond (often) site-unique OJT Instructor Guides.

d. ISD training for instructional developers is provided at USN instructional development centers. This is based on NAVEDTRA 106A (Reference 9) but also tends to be site unique.

e. No standardized training is provided for the managers of instructional development.

While the USN may appear deficient in this area, it should be noted that a concerted process for organizing and integrating all instructionally related activity in the USN is currently in progress. It is projected that standardization of instructor preparation and instructional management in the ISD context will be accomplished in this effort.

A.1.3 Canadian Forces (CF)

The CF employ a unified approach to performance-based instruction following their interpretation of the ISD model. It is a single policy applied service wide as in the USAF. All individual training is developed, conducted and controlled in accordance with DND CFP-9000 series, "Manual of Individual Training" (Reference 10). This manual also serves as the principal training reference for those involved in the development, conduct, and management of training. It is well written, detailed, and comprehensive as the outline below suggests:

Volume 1 - General
  Part 1 - Introduction
  Part 2 - Description of the Individual Training System
Volume 2 - Analysis for Individual Training
Volume 3 - Design of Individual Training
  Part 1 - Courses

  - Part 2 - Conduct of On-Job Training
- Volume 4 - Conduct of Course Training
  - Part 1 - School Management
  - Part 2 - Instructional Technique
  - Part 3 - Instructor Reference (Principles, methods, aids, etc.)
  - Part 4 - Learning Aids
  - Part 5 - Programmed Learning
  - Part 6 - Computer-Assisted Learning
- Volume 5 - Evaluation of Individual Learning
- Volume 6 - Validation of Individual Learning
- Volume 7 - Statistical Reporting Procedures
- Volume 8 - Catalogue of Training Standards

No information was obtained during the survey regarding the qualifying and certification process for instructor and other instructional personnel in the CF; however, that process is also based on Reference 10.

A.2 FEDERAL AVIATION ADMINISTRATION (FAA)

The FAA certifies all aviation instructors that provide ground, flight, or aircraft maintenance training in accordance with their aircraft rating. To complete this certification, a candidate must satisfy the following requirements:

a. To verify minimum acceptable technical knowledge, the candidate must hold a certificate appropriate for the flight rating for which instructor certification is sought.

b. The candidate must pass an FAA written examination in the following subjects:

   o The learning process,

   o Elements of effective teaching,

   o Student evaluation, quizzing and testing, o Course development,

o Lesson planning, and

o Classroom instructing techniques.

The FAA provides the information with respect to these subjects in Advisory Circular (AC) 60-14, "Aviation Instructor's Handbook" (Reference 11).

c. For the flight instructor position, the candidate must also have satisfactorily completed practical instruction given by a person who is a certified flight instructor. This instructor training must include the following subjects:

o Preparation and conduct of lesson plans for students with varying backgrounds and levels of experience and ability,

o Evaluation of student flight performance,

o Effective preflight and postflight instruction,

o Flight instructor responsibilities and certification procedures,

o Effective analysis and correction of common student pilot flight errors and,

o Performance and analysis of standard flight training procedures and maneuvers appropriate to the flight instructor rating sought.

At the completion of this training, the flight instructor candidate must pass an FAA-administered practical test on these subject areas. This test includes both oral and flight portions. The specifics of the test are published by the FAA in AC 61-58A, "Flight Instructor Practical Test Guide" (Reference 12). For both the oral and flight tests, specific objectives and performance standards are defined. The first item from the oral test portion (duplicated below) exemplifies the level of detail addressed in these tests.

FLIGHT INSTRUCTOR PRACTICAL TEST

Oral Test

1. Preparation of Flight Lesson Plan

Objective

To determine that the instructor applicant can develop an organized and effective flight lesson appropriate to a student with specified educational and general experience who is at a specified stage of flight training.

1. Description The instructor applicant will be requested to prepare, after reporting for the test, a lesson for a student with the background, flight experience, and aptitude specified by the Inspector/Examiner. A previously prepared lesson plan will not be accepted. The lesson plan should include at least:

a. The student's name and date of the lesson:
b. The lesson subject (assigned by the Inspector/Examiner);
c. Objectives of the lesson;
d. Flight elements involved;
e. Schedule of training within lesson;
f. Equipment to be used;
g. Instructor's actions;
h. Student's actions; and
i. Evaluation standards.

The assigned lesson will be appropriate to the flight instructor rating sought and consist primarily of a demonstration of dual flight instruction given by the applicant. The lesson should take no more than one hour of flight time.

2. Acceptable Performance Guidelines The instructor applicant shall be able to prepare, in not more than 20 minutes, a flight lesson appropriate for the specified "student." The lesson plan shall be appropriate to the assumed background, flight experience, and aptitude of the "student" and in sufficient detail for the training proposed. The evaluation standards for completion of the lesson shall match the lesson objective.

Upon successful completion of the written, oral, and practical examinations, a flight instructor certification is granted by the FAA. This certification is valid for 24 months and may be renewed by one of the following methods:

- Pass another practical test for a flight instructor certificate,

- Have a record of instruction that demonstrates competency as an instructor,

- Have a satisfactory record in an activity involving the regular evaluation of pilots (for example, as a check pilot, chief flight instructor, etc.) and pass any oral test necessary to determine knowledge of current pilot training and certification requirements, or

- Successfully complete an FAA-approved flight instructor refresher course of at least 24 hours of instruction.

This training certification program is mature and pre-dates the U. S. Military's ISD program. While the development of the program was not formalized in the ISD manner, it is clear that the end product is a competency- or performance-based training/evaluation program for FAA-certified instructor personnel. The longevity of the program attests to its effectiveness.

A.3 INSTITUTE OF NUCLEAR POWER OPERATIONS (INPO)

In October 1982, INPO issued "Guidelines for Technical Instructor Training and Qualification," INPO 82-026 (Reference 13). This document provides an INPO recommended qualification program with respect to both the technical competence and the instructional skills of instructors for operations, maintenance, and technical support personnel.

An INPO instructor job analysis, along with existing industry training programs, and the experience of INPO and industry reviewers were used in developing the guideline. While the foreword to the document indicates that the guidance may be modified based upon the results of task analysis, there are no current plans for conducting this task analysis.

Shown below is a summary of the subjects addressed in the recommended instructional skills training program together with the recommended number of instructional (contact) hours to be devoted to each subject.

Subject	Recommended Contact Hours
The role of the instructor	2
Principles of instruction	3
Using records and assessment results of incoming students	3
Classroom methods	5
Presenting classroom instruction	10

Subject	Recommended Contact Hours
Using lesson plans	5
Instructional materials and media	4
Classroom arrangement	2
Evaluating trainees	4
Maintaining and using trainee and program records	2
The learning hierarchy	3
Instructional development	4
Planning and developing an instructional unit	7
Developing lesson plans	12
Selecting, developing and modifying instructional materials and media	6
Developing instructional measurement instruments	8
Presenting laboratory instruction	12
Individualized instruction	4
Conducting walk-throughs and station tours	8
On-the-job training	12
Trainee stress	2
Trainee conferences (counseling)	2
TOTAL	120

The guideline recommends that procedures be established to certify both instructional skills and technical competence. Certification of instructional capability is to be based upon completion of an instructional skills training program, similar in content and length to the recommended program, and an evaluation of on-the-job performance (based upon the tasks for the specific instructor position). Maintenance of certification is recommended based upon satisfactory on-the-job performance and participation in continuing training.

INPO's program for accreditation of training programs is described in INPO Criteria Document 85-002, "The Accreditation of Training in the Nuclear Power Industry" (Reference 14). Among the criteria for accreditation in this document are the following related to training staff qualifications, development and evaluation:

- The duties and responsibilities of the training staff are clearly defined.
- Technical instructors (utility and contracted training) possess the following qualifications:
  - (1) technical training and experience consistent with the subject matter taught [and]
  - (2) instructional skills appropriate for assigned instructional duties.
- Staff members responsible for program development have appropriate education, training, and experience qualifications for the position.
- When instructors have not yet attained the required instructional qualifications or only instruct occasionally, the training quality is maintained through appropriate and qualified assistance and supervision.
- Initial and continuing training of instructional staff members is developed and implemented.
- Criteria and procedures for evaluating and ensuring the qualifications of the training staff are established and implemented.

- Instructor performance is evaluated regularly and the results are used to improve performance.

- Opportunities for continuing development are provided for training staff in response to both individual and organizational needs.

- Those who regularly provide technical training maintain their technical qualifications and their familiarity with job requirements through in-plant activities.

A.4 U.S. NUCLEAR REGULATORY COMMISSION (NRC)

The nuclear power industry, through commitment to the INPO-managed Training Accreditation Program, is implementing performance-based training programs for NPP personnel. As indicated in the "Commission Policy Statement on Training and Qualification of Nuclear Power Plant Personnel" (Reference 1), the NRC will allow the industry a minimum of two years of accreditation activity without the introduction of new NRC training regulations. However, the NRC will continue to closely monitor the process and its results. Included in this monitoring will be:

- Continuing evaluation of industrywide training and qualification program effectiveness and

- Conduct of performance-oriented inspections.

Because most NRC personnel who might be engaged in training review may not have experience or formal training in performance-based training systems, it was found necessary to develop training review criteria and procedures to aid NRC personnel in conducting these reviews. The procedures are organized around the five essential elements of the Systems Approach to Training and provide specific, objective standards for evaluation with respect to each of the five elements. Figure A-2 is an example review question from the procedures. The standards associated with these questions are directly related to skills and knowledge that utility instructional personnel must possess to implement performance-based training programs.

REVIEW GUIDANCE

(1.1*) Was a systematic method used for identifying the tasks that make up the job(s) being evaluated?

A method or procedure is considered to be systematic if it possesses the following characteristics:

- o Consists of a logically ordered set of steps,
- o Is clearly documented so that it can be executed with consistent results on different occasions by different personnel,
- o Requires a physical record (e.g., signature) of external review/approval for historical accountability, and
- o Results in a consistently formatted, quality product (where applicable).

A task is a unit of work that describes the performance of a complete meaningful function in a job. An example of a task for the health physics (radiation protection) technician job is:

"Perform pre-Radiation Work Permit (RWP) surveys."

SCORING GUIDANCE

Score this question as a:

① if there is no task list, or if the task list is an industry-wide task list or a task list developed for another facility that is used for this facility without review or validation, or
if there are no implementing procedures/instructions that describe the process for developing/validating the task list.

② if a plant-specific task list has been produced based upon a documented systematic method.

③ if a plant-specific task list has been developed that includes all of these characteristics.

- o Involvement in the process by experienced training professionals and job incumbents, and
- o Validation of the initial task list by two or more job incumbents through interview, survey, or a group review meeting, and
- o Approval of the task list by managers/supervisors of subject matter and training personnel.

REVIEW REQUIREMENTS

	NOT AT ALL	GENERALLY	COMPLETELY
(1.1*) Was a systematic method used for identifying the tasks that make up the job(s) being evaluated?	1	2	3

COMMENTS: ____________________

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* Indicates that this is a critical characteristic of the training program. A score of ① for this question indicates that the training program is "unacceptable" overall.

Figure A-2. Example Training Review Criteria and Procedures Question

A.5 U. S. DEPARTMENT OF ENERGY (DOE)

For DOE-owned Category A Reactors (>20 MW), DOE requirements/practices with respect to training and instructor qualifications closely parallel those of NRC and INPO. DOE Order 5480.1A, Chapter 6 (Reference 15), which specifies safety requirements for DOE-owned reactors, stipulates the use of ANSI/ANS 3.1-1980 (Draft) (Reference 16) and U.S. Nuclear Regulatory Commission Regulatory Guide 1.8, September 1980 (Draft) (Reference 17) for the training and qualification of personnel for Category A reactors on an "as appropriate" basis. As indicated in Section A.6 of this report, DOE contractors are providing instructor training based upon INPO "Guidelines for Technical Instructor Training and Qualification" (Reference 13).

DOE TRADE (Training Resources and Data Exchange) has developed a "Training the Occasional Trainer" manual (Reference 18).

The major topics or modules covered in each course in this manual are listed below:

Half-Day Course

Instructional Objectives
Training Methods

One-Day Course

Defining Your Audience
Instructional Objectives
Training Plan
(Training Methods)

Two-Day Course

Defining Your Audience
Instructional Objectives
Training Plan
Training Methods
Audio-Visual Aids
Evaluation
Group Dynamics
Trainer Styles

DOE has issued "Guidelines for Job and Task Analysis for DOE Nuclear Facilities" (Reference 19) which closely parallels the approach used by INPO for job and task analyses. For Category A reactors, DOE has also implemented a training program evaluation process similar to INPO's accreditation process by issuing in January 1984

DOE/EV/107-82-T1, "Guidance for Training Program Evaluation" (Reference 20). A self-evaluation conducted by the DOE contractor operating the reactor is followed by a DOE field office review. The qualifications of the instructional staff are included in the evaluation. The level of detail and structure of the criteria for evaluating instructor qualifications provided in Reference 20 are similar to INPO's accreditation criteria as described in Section A.3 of this report.

A.6 NUCLEAR SERVICE COMPANIES/TRAINING MATERIAL VENDORS

There are a great variety of "train the trainer" services provided by vendors:

- Custom-designed workshops,
- Generic workshops,
- Off-the-shelf manuals, instructor guides and videotapes, and
- Structured on-the-job training.

Rather than conduct an across-the-board review of programs available from all vendors, the survey was limited to vendors that serve primarily the nuclear industry. The survey was further focused on programs that were oriented toward performance-based training. Three of these programs are briefly described in the remainder of this section.

A.6.1 UNC Nuclear Industries

UNC operates the N-Reactor in Richland, Washington, for the U. S. Department of Energy (DOE). In response to UNC's internal need for technical instructor training as well as the needs of other contractors that operate DOE-owned reactors, a one-week instructor training course has been developed. Course content was based on INPO's "Guidelines for Technical Instructor Training and Qualification" (Reference 13). The course is organized in nine modules:

- Instruction and Learning,
- Instructors and Students,
- Instructional System Design (ISD),
- Instructional Media,
- Program Development,
- Presentation Techniques,
- Evaluation and Audits,
- Development and Administration of Testing, and
- Development and Administration of OJT.

This course has been conducted on several occasions by UNC, attended by UNC instructors as well as instructors for other DOE contractors.

A.6.2 General Physics Corporation (GPC)

GPC has also developed an instructor training program designed in accordance with INPO's Technical Instructor Training and Qualification Guideline (Reference 13). This program comprises four workshops:

- Fundamentals of Classroom Instruction (40 hours),
- Principles of Instructional Design (40 hours),
- Systems Approach to Training (24 hours) and
- Supervising Training (32 hours).

This training is available either as generic workshops at vendor facilities, on-site workshops, or as textbooks and instructor guides for use by the facility's staff.

GPC also offers workshops in specific instructional skills including:

- Measurement and Practical Skills,
- Test Development: Evaluating Cognitive Learning,
- Job and Task Analysis: Training Applications for Industry,
- Designing Instructional Programs Using JTA Data,
- Establishing a Technician Qualification Program and
- Selecting Off-the-Shelf Training Materials: A Decision Framework.

A.6.3 Memphis State University (MSU)/Center for Nuclear Studies

MSU has developed and conducted workshops on Improving Instructor Effectiveness targeted for utility and DOE contractor personnel. This four-day program has been presented on the campus of MSU. Shown below are the major topics of the workshop:

- Conducting and using a Training Needs Analysis (TNA).
- Conducting a Job/Task Analysis (JTA), using existing JTA data, adapting JTA methods to your organization.
- Deriving training and learning objectives from JTA data.
- Formulating a Training Program Management Plan (TPMP).
- Writing lesson plans, writing and evaluating test items, selecting presentation methods.

- Interpersonal dynamics, instructor-student interaction.
- Conducting and using a Computer-Assisted Instruction (CAI) feasibility study.
- Evaluating training effectiveness, assuring quality control, developing and using Job Performance Measures, selection testing.

A.6.4 Computer-Based Training (CBT)

There were no comprehensive CBT instructional skills development programs identified. There are, however, individual components of an instructional skills program that are available in this media (e.g., how to use individualized instruction, needs analysis/task analysis). This conclusion is based on discussions with two of the largest CBT system vendors: Control Data Corporation (CDC), which markets the PLATO system; and Hazeltine, Inc., which markets the TICCIT system. In addition, a review was conducted of commercially available CBT instructional software as cataloged by the American Society of Training Developers and Training magazine in their respective buyer's guides/market place directories.

A.7 NUCLEAR FACILITY IN-HOUSE PROGRAMS

Two nuclear facilities were selected based upon the known commitment of the individuals responsible for instructor training and qualification to the Systems Approach to Training (SAT). The following sections describe the programs.

A.7.1 Public Service Electric and Gas Company (PSE&G)

PSE&G is the licensee/applicant for the Salem and Hope Creek plants. A central Nuclear Training Center is provided for these plants in Salem, New Jersey. During the past year, PSE&G has completed the implementation of comprehensive, well-documented instructor training, qualification, and certification programs. The initial instructor training course is six days long and is divided into three major sections:

- ISD Approach to Training (three days),
- Instructor Implementation Skills (two days), and
- Classroom Management (one day).

The content of this program is cross-referenced to a validated task list for instructors (the lesson plan in which the task is trained is indicated for each task). A combination of written, oral, and performance tests is used to evaluate instructor trainees.

A checklist is used to document the attainment of criteria necessary for instructor certification in three areas:

- Technical competence,
- Supervisory skills, and
- Instructional capability.

The Manager-Nuclear Training is responsible for certifying all PSE&G Nuclear Training Center (NTC) instructors. The qualifications of PSE&G employees other than NTC staff must be documented prior to their performing any check-off functions through a form indicating the areas in which they are qualified to administer check-offs. In addition, those personnel providing station training must attend a three-hour OJT training course.

A.7.2 Detroit Edison Company

Detroit Edison is the applicant for the Enrico Fermi 2 (EF-2) plant. This plant loaded fuel in early 1985. In 1983, an instructor training course was implemented with the objective of "providing instructors/instructional designers with the knowledge and skills necessary to effectively perform their jobs, both as classroom instructors and as instructional designers." The foreword to the course indicates that "while no formal requirements exist regarding this course, the course meets the intent of INPO Guidelines 82-026 [Reference 13] as well as NUREG/CR-1750, 'Analysis, Conclusions, and Recommendations Concerning Operator Licensing' [Reference 21]."

In addition to discussions/lectures, the course provides exercises and activities including:

- Video-taped role plays (i.e., practice lectures),
- Development of lesson guides,
- Specification of objectives,
- Writing test items, and
- Conducting job and task analyses.

For instructors with previous experience/education, the course is scheduled for 80 contact hours. For individuals without this experience, about 120 contact hours are expected.

A.8 ACADEMIC INSTITUTIONS/PROFESSIONAL ORGANIZATIONS

A.8.1 University of Central Florida (UCF)

Some universities and colleges, particularly those in the local area of USN and USAF commands that implement ISD, have developed instructional technology specialist programs. An example is the University of Central Florida (UCF), College of Education. UCF is located in the same local area (Orlando) as the U. S. Navy Training Equipment Center (NTEC). In 1980, UCF began a graduate program in instructional technology (IT). This program requires a minimum of 36 semester hours and includes the following courses:

Required

- Fundamentals of Graduate Research in Education
- Research Project
- Instructional Technology -- A Survey of Applications
- Instructional Systems Design
- Graduate Internship
- Multi-Media Message Design

Electives

- Statistics for Educational Data
- Measure and Evaluation
- Current Trends in Instructional Technology
- Computer Assisted Instruction
- Computer Applications in Instructional Technology
- Advanced Production.

A major factor in the criteria of the IT program at UCF was a formalized curriculum development process called Developing a Curriculum (DACUM). The results of the DACUM analysis for the IT program at UCF were 126 competencies (skills, knowledge and attitudes) clustered around the following seven major areas:

- Conduct Analysis
- Design System/Program
- Develop and Produce System/Program
- Conduct Evaluation
- Organize/Manage Instructional Systems/Programs
- Communicate
- Professional Skills.

Currently, UCF is evaluating requests for other academic programs in IT including:

- Associate of Science Degree,
- Undergraduate major in IT and
- Undergraduate minor in IT.

A.8.2 Association for Educational Communications and Technology (AECT)

The AECT Division of Instructional Development (ID) has an on-going Task Force on ID Certification. In 1978, this Task Force initiated efforts to develop instructional/training development core competencies based upon the following assumptions:

1. The competencies are performance oriented rather than academic oriented.
2. The competencies reflect the skills of experienced professional developers, not students or trainees.
3. All professional developers should be able to perform most, if not all, the competencies.
4. The competencies provide a basis for self-assessment and potential professional certification.

During a three-year period, the competencies were refined based upon input from members of the AECT, the American Society for Training and Development (ASTD), and the National Society for Performance and Instruction (NSPI). The Task Force is currently developing certification testing based upon these core competencies.

A.8.3 American Society for Training and Development (ASTD)

Subsequent to the AECD Task Force's efforts to develop instructional/training development core competencies, the ASTD initiated a similar effort. In June 1983, the ASTD published "Models for Excellence: The Conclusions and Recommendations of the ASTD Training and Development Competency Study" (Reference 22). The competencies described in this document are largely consistent with the AECT core competencies.

Building upon "Models for Excellence," ASTD has in progress a study with respect to the development of professional standards and certification of human resource development (HRD) practitioners (including training and development personnel). In October 1984, a questionnaire was distributed to ASTD members. The responses are being processed and will be made available to ASTD numbers in 1985. Among the topics treated in the questionnaire were:

- The form standards and certification might take,
- The need for standards and certification,
- The methods for certification,
- The use of certification, and
- Barriers to certification.

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14 ABSTRACT *(200 words or less)*

This report provides information to nuclear power plant training managers and their staffs concerning the job performance requirements of instructional personnel to implement performance-based training programs (also referred to as the Systems Approach to Training.) The information presented in this report is a compilation of information and lessons learned in the nuclear power industry and in other industries using performance-based training programs.

The job performance requirements in this report are presented as instructional skills objectives. The process used to develop the instructional skills objectives is described. Each objective includes an Instructional Skills Statement describing the behavior that is expected and an Instructional Skills Standard describing the skills/knowledge that the individual should possess in order to have achieved mastery. The instructional skills objectives are organized according to the essential elements of the Systems Approach to Training and are cross-referenced to three categories of instructional personnel: developers of instruction, instructors, and instructional managers/supervisors.

Use of the instructional skills objectives is demonstrated for reviewing instructional staff training and qualification programs, developing criterion-tests, and reviewing the performance and work products of individual staff members.

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